1969
Conference of Model Reporting Area for Blindness

PROCEEDINGS

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PROBLEMS IN MAINTAINING A REGISTER OF THE BLIND IN SOUTH DAKOTA

HOWARD H. HANSON [1]

SOUTH DAKOTA has experienced the usual difficulties and problems in updating and maintaining its register of blind persons living in the State. Obtaining recent medical information continues to be a problem. The mobility of people also poses its problems in keeping addresses current.

The department maintains a working arrangement with the Department of Public Welfare wherein all applications for aid to the blind are sent through our office to the medical consultant for verification of eligibility. As soon as the medical is received the department obtains a duplicate copy, thus insuring 100 percent referral of all Aid to the Blind applicants. This month we have completed an integrated action plan with the Department of Public Welfare wherein the Welfare Department agrees to refer all persons receiving categorical assistance who have severe visual problems. Their semiannual social service report will contain a question concerning the adequacy of vision. It is hoped that under this arrangement we will be able to correct our register on a continuous basis throughout the year.

Experience has taught us that busy eye doctors dislike lengthy eye reports unless there is necessity for all of the information contained therein. Hence, we have developed an application form for Talking Book Service (see fig. 1), which requests the individual applying for this service to forward the application to his or her eye doctor so that he can complete the medical section required for Model Reporting Area (MRA). The instructions for preparation of this form are presented in figure 2. Our registrar of the blind is also using a simplified letter requesting the necessary medical information on those individuals where release statements have been signed. The eye doctors have appreciated this simplicity and have cooperated marvelously with us in the short time we have used this system.

The department sponsored a reporting law in the 1969 legislature which would protect the physicians and other organizations from liability suits and permit their reporting all known cases of blindness. Unfortunately, the Medical Association read into this legislation that it was to be "mandatory reporting" and succeeded in having the bill defeated in committee. We will reintroduce it in the 1970 legislature and hope to obtain its passage.

---

[1] Director, South Dakota Service to the Blind and Visually Handicapped.

REQUEST FOR FREE TALKING BOOK LIBRARY SERVICE FOR THE BLIND AND PHYSICALLY HANDICAPPED (CONFIDENTIAL REPORT)

I. Name____
Street address__________________ Town__________ Zip______
Date of birth: Month_____ Day___ Year____ Sex: Male___ Female___
Race: W___ N___ I___ Other___ Marital status: S__ M__ Separated___ D___ W__________
Living arrangements: Alone___ With spouse____ With children___ Home for the aged____ Other___ Specify______
Education: Last grade______________
Reading interests: Magazines___ Fiction___ Religious___ History____ Travel___ Western___ Nonfiction___ Other_______

II. Certification for physically handicapped

The above named applicant has the following disability which prevents holding or reading normal printed materials: (specify) ____________________
____
Signature____________________ Title____________________

If you are physically handicapped only, and have completed parts I and II, your application may be forwarded to: Service to the Visually Impaired, 222 East Capitol Ave., Pierre, S. Dak. 57501.

III. If you are Blind or Visually Impaired the following information is required:
Age at which you could no longer see to read___ Other handicaps________
Occupation prior to loss of sight______________ After loss__________

I hereby authorize my doctor to release all of my medical information to South Dakota Service to the Visually Impaired.

Signature of client, or guardian____________________________

After completing parts I and III, have your eye doctor complete the following report.

Best corrected visual acuity or field restriction: Disease or condition_____
Right__________ Left__________ Cause_________________
Date of last examination__________ Signature_________________
Specialty_________________

After completing eye report please send form to: Service to the Visually Impaired, 222 East Capitol Ave., Pierre, S. Dak. 57501.

IV. For use by Service to the Visually Impaired
Machine serial No.____________________
Date sent________________________
Issued by________________________

FIGURE 1

INSTRUCTIONS TO APPLICANTS FOR TALKING BOOK SERVICE

The South Dakota Service to the Blind has the responsibility for distributing talking book machines and authorizing the initiation of service from the South Dakota Library for the Blind and Physically Handicapped located at 701 East Sioux, Pierre, S. Dak. All applicants for talking book machines for individuals, institutions, nursing homes, and librarians must be processed through the Service to the Blind, 222 East Capitol Ave., Pierre, S. Dak.

The attached application form is for your convenience. Applicants who have only a physical disability other than vision are instructed to complete parts I and II of the form before submitting. The section "Certification for Physically Handicapped" should be completed by a medical person, a nurse, therapist, social worker, nursing home manager, or a librarian knowledgeable of a community or of residents remote from other facilities.

Applicants with a vision disability must complete parts I and III. Please follow the instructions concerning the eye doctor completing the questions on visual acuity. After he has completed this section, he will forward the form to Service to the Blind.

Upon receipt of the application, a talking book machine will be issued to eligible readers and the Library for the Blind and Physically Handicapped will be notified to initiate library services. Should your talking book machine ever need repair, it should be returned to the Service to the Blind indicating whether you desire to have it replaced. We hope you will enjoy this new service in South Dakota.

FIGURE 2

PROBLEMS IN DEVELOPING AND MAINTAINING A REGISTER OF BLIND PERSONS IN OREGON

CLIFFORD A. STOCKER [1]

PERHAPS THE MOST important problem about developing and maintaining a register of blind persons in an area is a sincere belief in its value or worth to a well-rounded program of services to blind people in that area. Without such a tool it is almost impossible to identify the problem of any population of the blind. If the tool is inadequate, the proposed solutions to these problems may very well carry through the blemish of this inadequacy. Hence, it is essential that all parties concerned—the client, the ophthalmologist, the professional worker for the blind, the clerical persons, and last but far from least, the registrar and the community—be convinced of the worth of a register and the need of it being scientific and detailed. This belief does not nurture itself, but rather it must have continuing intravenous feedings. This job is usually performed by the registrar or person supervising the registrar, although each and every worker in the agency should be involved.

The second most important problem is that of selecting the personnel who are going to develop and maintain the register. This job cannot be assigned to anyone who will take it without griping too much. It must be assigned on a very selective basis and it may very well take one of the agency's most capable and most intelligent persons. The staff member selected must first of all be imbued with the belief that in order to find solutions to problems, one must identify the problem.

With the problem identified, then the solutions become a matter of concern primarily to the administrator and his planning staff, but almost inevitably involve the community and all of its organizations, including most certainly the legislature and State department of finance.

We are now faced with the third big problem in developing and maintaining a register of blind persons—that of educating the community. I am sure this sounds like old hat to those of you who have been working in programs of service to blind people or for that matter programs of service to humanity. Nevertheless, it still remains a major problem. Ever since the dawn of history, man has resisted being numbered as is witnessed by the stringent measures taken by the jews during the days of Moses and others among their great leaders. Man is still resisting being numbered and this is particularly true when you are numbering him because he possesses a physical or mental characteristic which singles him out as being different from all his other fellowmen. Not only does the blind person resist being numbered, but he receives a good deal of aid from his family, his friends, and very often his doctor. I do not purport to have the answers to this consolidated resistance—I can only say it's there and the only way it can be overcome is through a well planned, on-going program of educating all who should be involved. Of course, there are many little gimmicks that can help to get the message across, such as involving the agency's consulting ophthalmologist (providing, of course, he has been educated to the need and importance of the register) to impress his fellow ophthalmologists on the importance of referring their patients. Radio and TV spot announcements can be of material assistance in educating the public and the blind potential registrant. Here the American Foundation for the Blind and for that matter, the National Institute of Neurological Diseases and Stroke could help the local or State agency since very often people are more prone to be influenced by outside expertise than they are by their own home folk. I do not believe it is wise to tie such services as the talking book and free fishing licenses in with a mandatory registering of the blind recipient of these services. All too often, such a requirement will only backfire in provoking a greater resistance and the age-old cry of "unnecessary red tape." These services can be used as a pry or an entree to gain the attention of the blind person while you subtly educate him to the importance of his becoming a registrant. This may seem sort of like slipping up on his blind side but when it is adroitly done it is really quite painless and does get the job accomplished.

---

[1] Administrator, Oregon Commission for the Blind.

I think perhaps the fourth major problem is making use of the register. Although this problem is closely related to the process of educating the public and might well be considered as only a facet of that process, I do believe it has a broader more technical significance. As all of you know, legislators, budget analysts, and the public have been schooled to ask for numbers when granting the aid of their hard earned sheckles to the support of programs for the blind. Doctors who are concerned with the development of preventive measures for the protection of people and the stamping out of disease are also concerned with the prevalence factor. Professional workers seek knowledge about causes of blindness and the limitations imposed by these causes. Administrators should be aware of the scatter of the blind population. Hence, the proper use of the blindness register becomes even more important. Too much data can only serve to defeat the purpose, too little may make it appear useless. The solution to this problem is not only the responsibility of the administrator but it is also incumbent upon the registrar to feed the data to the administrator and the staff of the agency so they may make use of these.

Finally, I would say a fifth big problem is a conglomerate of many technological details not all of which can be here identified or enumerated. Frankly, I don't believe they have all come up as yet. Certainly, coding is one of them, reporting cases to the registrar by the rest of the staff is another, getting the data on the punch card is yet another and so on and on ad infinitum. I would be here the rest of the day if I tried to list them all.

I know I have not set forth all the problems. I hope, however, I have identified a few and I don't propose to have all the answers. In summary, I would say the major problems in developing and maintaining a register of the blind persons living in a given area may be grouped into five broad categories as follows:

(1) Developing a positive philosophy or belief in the worthwhileness of a register.
(2) Selecting the proper persons to do the job.
(3) Educating the community in the broadest connotation of the meaning of the word "community."
(4) Making proper use of the register.
(5) Overcoming technological difficulties as they arise.

You have been a most courteous audience and I thank you for the use of your shoulders while I wail about the problems we have encountered in Oregon in our efforts to develop and maintain a register of Oregon's blind population. I know Mrs. Sokolow could tell you of many more, but lest you begin to think I, too, believe in long engagements I'll sit down and shut up.

PROBLEMS ENCOUNTERED IN MAINTAINING A REGISTER OF BLIND PERSONS IN LOUISIANA

EVALENA FORD[1]

LOUISIANA has continued to use her annual registration updating plan as outlined in her MRA report of 1966. The 1967 updating completely cleared the register of unknown individuals.

Once a year a Newsletter is sent to all registrants giving information regarding a specific eye condition and news about services available from the division.

Louisiana maintains a "Blind Services Code Register" with all programs coded, which shows the type of service given each blind person and the duration of such service, Aid to the Needy Blind, Vocational Rehabilitation, Social Adjustment, Talking Book Machine, Newsletter, etc. This is an elimination process. It enables the division to determine annually how many persons on the register did not receive services during the year.

All persons shown on this register who did not receive a service, other than the Newsletter, are sent a double post card, prestamped and self-addressed for return. This asks recipient a few questions about change of address, physical and social status and eye condition. Cards returned by the post office as deceased, unclaimed, unknown, moved left no address, are referred to our field staff for clearance.

From the beginning of the MRA program, Louisiana has had the cooperation of the personnel of both the statistical division and the machine room. This year, however, Louisiana is experiencing difficulty in keeping up with the monthly changes in clients' residences and categories. Data processing is on a day-by-day machine updating procedure which is done by case number instead of by case name. So far they have not been able to give us scrolls by case name and the manual process is very time consuming. Hopefully, this will be cleared by December. We are working on this problem.

Each year after the MRA Tabulation Bulletins are received, copies are mailed to all ophthalmologists and Eye Ear Nose and Throat physicians in the State, with a cover letter regarding the service and asking them to sign the letter, add their remarks and return it to us in the enclosed self-addressed stamped envelope. About 40 percent do reply. Physicians respond, however, when they find a need for our services, such as Talking Book Machines and payment for eye services under rehabilitation and under title XIX.

---

[1] Medical Social Consultant for Eye Services, Division for the Blind, Louisiana Department of Public Welfare.

Louisiana Division for the Blind receives referrals of blind individuals from many sources including Aid to Needy Blind (ANB), Rehabilitation, Old Age Survivors Disability Insurance (OASDI), Eye-Ear-Nose-and-Throat Hospital, the three largest State hospitals, physicians, optometrists, schools, self, and Talking Book Machine requests. The Division for the Blind handles all the applications for Talking Book Machines. When applicant requests a machine because of a visual problem, a Certificate of Blindness is sent to be completed by an eye doctor. When certificates completed by ophthalmologists show blindness, applicant's name is added to the MRA register. When certificates completed by optometrists and others, show blindness, applicant's name is added to the State register.

This past year there were two special requests for statistics on blindness in Louisiana. The first was a request from the State Health Department which was working up a project relating to the incidence of diabetic retinopathy. The second request was from the Director of Ophthalmology of the Louisiana State University Medical School on the incidence of eye injuries in Louisiana. Marked copies of the last two MRA statistical reports were mailed to him. (He could not remember what happened to the six copies sent him last year.)

Louisiana is sorry to report that due to lack of established ground rules in MRA, it has not been possible to recode her total register according to the 1966 code book as planned. There are some 6,000 cases coded with the original codes. When the 1966 code book arrived in October 1966, Louisiana set about to systematically recode the register using the new code as she understood it. Approximately 16 percent of the register was recoded when two employees who were assigned to the work left. Due to lack of personnel, it has been possible only to handle new eye forms as they come in. Some of the forms have bounced back and forth between MRA and Louisiana so often they have been in transit most of the time during the past 2 years as Louisiana and MRA could not agree on their coding. So much time has been spent on these few forms that there has been no time to even consider the recoding of the register proper of about 6,000 cases. Louisiana was advised that the 1966 code book would be complete and be used at least 5 years. By the time it was received, there were several addendas and since then there have been additional addendas. Also, apparently rules of coding are still being made without formal reporting out to the States. Louisiana feels that a useable code should be sufficiently stable that it would not be necessary "to take form under further consideration" or "we decided it should be coded otherwise."

Louisiana appreciates the fact that Quality Control who does nothing but code, is in a better position to code these forms the way they want them than Louisiana who does it only once or twice a month. Our efforts to code under the current arrangement with the high number of disagreements is entirely too costly. Louisiana suggests that MRA take the responsibility of coding the eye reports and sending the codes to the States for their records.

GENETIC COUNSELING IN HERITABLE EYE DISEASES

RONALD E. CARR, M.D., M.S. (OPHTHALMOLOGY)[1] AND
IRWIN M. SIEGEL, PH. D.[1]

ALTHOUGH THE topic chosen for this paper is that of genetic counseling in eye diseases, we would hope that the main tenet to be presented would be applicable in any of the medical specialties. And that is: For correct genetic counseling and also for correct statistics within the area studied, the diagnosis itself must be correct. This fact is not so naive as it sounds, and as an example of this, one can consider the disorder which goes under the name of *Congenital Amaurosis of Leber* (*1*). This is a disease in which there is a severe degeneration of the retina, present at birth or shortly thereafter, and is one of the many causes of blindness during this time period. As an example of how prevalent this disease is, two separate studies (*2*, *3*), one in Holland and the other in Sweden, on very large samples, showed that approximately 18 percent of children in institutes for the blind had the disorder. However, without the use of certain specific tests the diagnosis often cannot be made, and the authors of these papers interestingly list some of the examples of erroneous diagnoses. Of note is that only 26 percent of the children with this disease were correctly diagnosed. Thus, this disorder, which is inherited as an autosomal recessive, was thought to be quite rare until specific diagnostic tests clarified the picture.

This certainly shows in a very gross way the value of proper diagnosis in terms of getting a correct incidence of a disorder and also in terms of genetic counseling. For it is well-known that many of the disorders leading to blindness in infancy are congenital but not hereditary, while this specific disorder has a well-documented hereditary pattern.

We have at hand many aids to help toward a correct diagnosis, and this is especially true in the study of retinal diseases. In the retinal diagnostic unit at the New York University Medical Center a great variety of problems are seen, and because of the severity of many of these disorders in terms of loss of visual function, genetic counseling is often sought by the family. To this end the necessity for correct diagnosis is obvious.

As an example of how certain tests of retinal function are of help in establishing a correct diagnosis, consider the patient who is seen with the subjective complaint of night-blindness that is, a patient who is unable to adapt to a dimly lit or dark environment.

---

[1] Department of Ophthalmology, New York University, School of Medicine, New York, N.Y.

In the group of diseases with this as the major subjective complaint there are two major categories into which the disorder may be separated: (1) A disorder in which there is a progressive deterioration of the retina and of retinal function, that group in which are included *retinitis pigmentosa and allied disorders;* and (2) the disorder in which there is no deterioration of function at all, but only a lack of dark adaptation, that group called *congenital stationary nightblindness.* The following case histories serve as examples of these disorders.

Case 1: *Retinitis Pigmentosa:* A 29-year-old white male had no ocular complaints until age 20 at which time he noted poor night vision. A maternal aunt had retinitis pigmentosa but was not seen for documentation. Both parents had normal eyes. Testing demonstrated conclusively the presence of a generalized retinal degeneration.

Case 2: *Congenital Stationary Nightblindness:* A 34-year-old white male had no complaints until age 23 at which time he entered the armed forces and noted difficulty in seeing while on night maneuvers. Because of the normal appearance of the retina the patient was thought to be a malingerer and was reassigned to duty. He was then seen at the National Institutes of Health after having driven a jeep into a ditch at night. Testing proved conclusively that this patient had congenital stationary nightblindness.

The similarity between the two cases lies in the main complaint (nightblindness) as well as the age of onset. Although in most cases the diagnosis of retinitis pigmentosa can be made by ophthalmoscopic visualization, there are these cases in which the differential cannot be made in this manner so other methods must be used to separate these disorders. These methods, while necessary in differentiating between these diseases can also be of aid in a wide variety of other retinal disorders. Also, there are disorders in which the fundus picture may mimic that of a generalized retinal degeneration and yet functionally the disorders are completely dissimilar (*4*).

Initially used are the psychophysical tests, all of which are subjective. The visual field test is one in which the outer borders of the field of vision are determined as well as exploring for the presence of any nonseeing (scotomatous) areas within the field. In the disorder of retinitis pigmentosa there is usually a severe compromise of the field so that either a markedly constricted field is seen or a large "ring" scotoma is found within the peripheral field of vision. On the other hand, the visual field in congenital stationary night-blindness is perfectly normal.

A second psychophysical test of value in these disorders is that of dark adaptometry. That is, a direct measurement of the ability of an individual to adapt to darkness. In the normal the dark adaptation curve is bipartite, that is, composed of two limbs. The first initial fall is attributed to the function of the cone receptors while the second, later limb is related to rod function. In the differentiation of the two disorders at hand, the use of this test is not always of real value, for in both cases dark adaptometry will be abnormal and show an absence of the rod response. On the other hand, this test can be very reliable in ruling out true disorders of dark adaptation and also in excluding from this group certain diseases in which the findings in the back of the eye may mimic one of the progressive degenerative states, as noted previously.

In our study of this group of patients we are next able to utilize the *electrophysiologic tests* of retinal function. That is, looking at certain of the electrical responses from the eye. The major test used in this capacity is the *electroretinogram* or *ERG*. This can be defined as a rapid, transient electrical response, arising from certain layers of the retina, in response to a flash of light. By demonstrating certain abnormalities of this response, specific disorders may be diagnosed and certain retinal layers may be judged as to their normalcy of function. A complete description of the technique, its indications, and findings in various disorders can be found in the recent ophthalmologic literature (*5*).

Another test which gives essentially the same information as the electroretinogram is the *electro-oculogram* or *EOG*. Although the physiologic basis of the test as well as the technique of performing it is different from the ERG, nevertheless the derived information is virtually the same. Again, a good description of the application of this test and its rationale can be found in the recent literature (*6*).

With the use of one or both of these tests in combination with the psychophysical tests of retinal function, the correct diagnosis in a patient with nightblindness can often be established. And when the diagnosis is made the heredity is important. Thus, in the disorders under discussion the following patterns can be found:

Congenital Stationary Night-blindness:
  (1) Autosomal Dominant.
  (2) Autosomal Recessive.
Generalized Retinal Degeneration:
  (1) Autosomal Dominant.
  (2) Autosomal Recessive.
  (3) Sex-linked Recessive.

In order to establish the correct hereditary pattern several steps are taken. First, a careful family history is gotten and second, the examination of as many other family members as is deemed necessary is performed. This point is of importance and interest in the sex-linked group of disorders, for here the female carrier may have no evidence of any retinal dysfunction and be completely sympton-free, yet the findings of the so-called carrier state may be seen in the retina (*7*).

The necessity of assigning the correct hereditary pattern to any affected individual with retinitis pigmentosa is because of the variation in the progress of the disease depending on the mode of inheritance. Thus, those patients with the autosomal dominant variety will show very slow progression and indeed may have good acuity into later life, whereas the other forms are much more rapidly progressive and these patients will need early visual rehabilitation training.

Further, the obvious need for assessing the heredity correctly in any of these disorders lies in the future of the family with regard to subsequent generations and the probability of affecteds within those generations.

Thus, in utilizing one specific group of retinal disorders as an example, the need and value of specific diagnostic tests become obvious in correctly assessing a disorder and then determining its hereditary pattern. This precept can be extended to encompass many other ocular diseases, and likewise, the specific tests noted can be of help in a wide range of retinal diagnostic problems.

This work was supported by grants NB 02589 and NB 35004 from the National Institute of Neurological Diseases and Blindness, National Institutes of Health.

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OHIO'S PROGRESS TOWARD MRA MEMBERSHIP

DORIS BARCOMB [1]

OHIO IS ON its way in establishing a blind register which will conform with MRA standards. In March 1968 a Research and Statistics section was established in our agency under a VRA (Vocational Rehabilitation Administration) grant. Among other responsibilities this section was assigned the task of establishing a current, accurate register of severely visually handicapped persons in Ohio. Although our State does not have a mandatory reporting law the Ohio revised code does specify that the Bureau of Services for the Blind shall maintain a blind register. Thus, we did have the advantage of having an old register as a starting point in setting up the new register.

The old blind register, which was started about 1936, had about 18,000 registrants listed. New additions had been added regularly and removals processed upon notification of death, recovery of vision, etc.; however, no concentrated effort had been directed toward contacting registrants for updating purposes. For this reason many of the listed addresses were found to be as much as 20 or 30 years old. It was also noted that over 300 registrants listed had birth dates prior to 1868.

After preparing new register cards, form letters, etc., our first step was that of cross-checking records from the various agency units, Aid to Blind listings, etc., to obtain the most recent available address on registrants. Despite this effort, sometimes the latest available addresses on file were found to be 10 to 20 years old. Concurrently with this cross-checking procedure, we prepared new register cards on those active clients actually receiving services from the agency within a 2- or 3-month period.

After procuring the most recent address available we began an update mailing to those old registrants not receiving recent services. As part of the material sent with the update mailing, we included a pamphlet describing the services of all units of our Bureau and asked that registrants indicate in their response any services needed or desired. This has resulted in many referrals to our units such as Vocational Rehabilitation, Talking Book, Children's Services, etc.

Procedures were established to assure that address changes, new referrals, deaths, etc., would be reported to this section for register updating. In this regard, we became the central clearing force for feedback of updated information to various other units of the agency.

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[1] Supervisor, Research and Statistics, Bureau of Services for the Blind, Ohio Department of Public Welfare.

Investigation disclosed that methods for reporting to the old register were fairly operational in some areas. Procedures for notifying the register of new blind residents in institutions, residential schools, etc., were found to be working effectively. Good liaison and referral exchange was noted between our Children's Services unit and the Special Education section of the Department of Education. Ohio State University Eye Clinic also maintains close reporting liaison with the register. The reporting from ophthalmologists, other eye specialists, and physicians, etc., does not appear to be as adequate as it is from other areas. Reporting from these persons seems to be contingent upon their desire to secure specific services such as the talking book for their severely visually handicapped patients.

Contact was made with agencies within the State which serve blind persons to assure their knowledge of the existence and purposes of the Blind Register. A letter was written for mailing to ophthalmologists to encourage reporting to the register but when presented to the State Ophthalmological Society for review prior to mailing they rejected it. Since attempts to determine the reason for this rejection have thus far been fruitless, we have been unable to revise the letter and complete this planned mailing to ophthalmologists within the State.

At present we have 9,500 individuals listed on our new register who have a visual loss classifying them within the definition of legal blindness. Medical coding on site/type and etiology is done by the supervisor of medical services with the assistance of our consulting ophthalmologist. This medical coding has been completed on 5,500 of those persons listed on the new register.

Update letters have been mailed to 13,500 of those persons listed on the old register. Approximately 8,000 answers have been received showing update information or reporting death. About 2,750 letters resulted in no response and were not returned by the post office. An additional 2,450 letters were returned with notations such as "addressee unknown" or "moved—forwarding address expired."

Continued efforts with this register will include completion of the update mailing to the 2,700 registrants remaining on the old register. Another step will involve rechecking addresses through private agencies, local welfare offices, etc., on those letters returned from the post office. A second mailing will be tried and final contact effort will be attempted through Vocational Rehabilitation counselors and other agency personnel.

Further contact will also be made with private agencies, eye specialists, etc., to assure quick referral to the register.

Based on our experiences with this updating and the registrants recorded thus far, it appears that if our register is to reflect a fairly accurate account of visually handicapped persons residing in Ohio it will consist of some 14,000 to 15,000 registrants.

Arrangements have been made to feed register information into data processing to provide quick, easy access to data contained in these records. This data should be extremely useful in research, program planning, answering inquiries, etc. It is anticipated that when completed our new register will meet all the standards for membership in the MRA.

A REGISTER OF DEAF-BLIND CHILDREN AND ADULTS

ROBERT L. ROBINSON[1]

MOST OF YOU know that the American Foundation for the Blind has from the outset concerned itself with the needs of deaf-blind persons. In this connection our Foundation together with the Rehabilitation Services Administration, HEW, contemplate the establishment of a national register of deaf-blind persons.

A pilot project to determine the feasibility of establishing such a register is being planned.

The proposed study is to be completed within 1 year and samples will be obtained from: Central cities; metropolitan areas; rural States; schools for the blind; schools for the deaf; private schools for the retarded; State schools for the retarded; private homes for the aged; and State or city mental hospitals.

Basic demographic information, ophthalmological; audiological; general physical and psychosocial data will be obtained (by direct interview) as well as medical examinations and testing.

We shall provide special examination forms for the pilot project.

The lack of reliable statistics on the number and principal characteristics of the deaf-blind population in the United States of America has prompted our Foundation to begin collecting data on a case-finding basis. The best estimates of the number of deaf-blind children in the United States of America is about 2,000 and of adults perhaps 6,000 to 8,000. Neither of these estimates are substantiated by reliable data. Since 1946, the American Foundation for the Blind has maintained a register that is national in scope. However, much of the data is based on case findings and does not lend itself to statistical compilation or manipulation.

The need for such national statistics has been greatly increased by recent amendments to the Vocational Rehabilitation Act. Public Law 90–99, approved in October 1967, authorized assistance in the establishment and operation of a national center for deaf-blind youths and adults. Public Law 90–247, approved in January 1968, provided centers and services for deaf-blind children.

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[1] Director, Social and Statistical Research Division, American Foundation for the Blind, Inc.

CAUSES OF BLINDNESS IN ADDITIONS TO MRA REGISTERS FOR 1967

RONALD J. WELCH[1]

THE MODEL REPORTING AREA (MRA) for Blindness is concerned with two distinct blind populations. One is referred to as the total on register and is composed of everyone on the registers as of a given December 31st. The other is known as additions to the registers.

Total additions for a year include additions which have never been registered before, termed first additions, and additions which have been registered before, called readditions. This paper is concerned only with those first additions which were examined by ophthalmologists or eye-ear-nose-and-throat specialists.

Since 1962, when MRA was initiated, causes of blindness have been classified with a seven-digit code.[2] Before 1965, each MRA State classified causes without any review by the National Institute of Neurological Diseases and Blindness (NINDB). In that year NINDB reviewed a sample of the total additions that the States had classified.

Also in that year, Russell R. Widner, M.D., Consulting Ophthalmologist to the Section on Blindness Statistics, developed a reclassification system for the seven-digit cause-of-blindness codes. The 418 different seven-digit codes were assigned to 18 different clinical categories, and the results were presented to the MRA conference held in 1967.[3]

NINDB reviewed the State assigned classifications for essentially all of the 4,965 additions in 1966, and revised the clinical grouping system by deleting the other retinal disease category and by combining the unknown and unclassified categories. It classified the causes of blindness in these 4,965 additions into 305 groups each identified by a distinct seven-digit code, combined these 305 groups into 16 clinical groups, and presented the results to the 1968 MRA conference.[4]

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[1] Statistician, Section on Blindness Statistics, National Eye Institute, National Institutes of Health.

[2] *Standard Classification of Causes of Severe Vision Impairment and Blindness,* National Society for the Prevention of Blindness, Inc., 79 Madison Ave., New York, N.Y.

[3] Widner, Russell R., M.D., "Reclassification of the 1965 Cause-of-Blindness Data." *Proceedings Sixth Annual Conference of the Model Reporting Area for Blindness Statistics, 1967.* U.S. Department of Health, Education, and Welfare, NIH, Bethesda, Md.

The 15 States in the MRA as of January 1, 1967, added 6,127 persons to their registers in 1967, including 5,443 first additions examined by ophthalmologists or eye-ear-nose-and-throat specialists. NINDB classified the causes of blindness in these 5,443 additions with seven-digit codes and grouped them into the 16 clinical categories used in 1966. The text which follows presents the results that were obtained.

Figure 1 shows that macular degeneration, which blinded 18 percent of total additions for 1967, was the most frequent cause of blindness. Cataract was the second most frequent, blinding 15 percent, and glaucoma third with 13 percent. Diabetic retinopathy and congenital defect were fourth and fifth, representing 11 and 10 percent respectively. Abiotrophic chorioretinal disease and degenerative myopia was sixth, blinding 7 percent. All other causes affected less than 5 percent of the 1967 additions. The category comprised of unknown and unclassified causes of blindness accounted for 8 percent of the additions. Therefore, it would have been sixth if it had been ranked with the other categories.

Figure 2 shows that the three most frequent causes combined blinded 46 percent of the additions, and that the seven most frequent blinded 77 percent of them. Only 15 percent of the additions were blinded by the other eight known causes, because 8 percent were blinded by causes which were unknown or could not be classified.

Figure 3 divides the additions into four age groups. It distributes these persons by their age as of 1967 when they were added to registers which is not necessarily their age when blinded. The 249 additions for which age was unknown or not reported were omitted. The over 60 age group accounted for 54 percent of the additions. Twenty-three percent of the additions were in the 41–60 age group. Thirteen percent were in the 0–20 age group, leaving only 10 percent for the age group 21–40.

Figure 4 shows for each cause of blindness the average age of the additions when they were added to registers. The average age exceeded 70 for macular degeneration and glaucoma, two of the most frequent causes of blindness in additions for 1967. The average age was between 60 and 70 for cataract, retinal vascular disease, diabetic retinopathy, corneal disease, and for the unknown and unclassified category. It was 19 for congenital defect and 15 for retrolental fibroplasia. The lowest average age, which was five, was reported for retinoblastoma.

Figure 5 distributes four of the more common causes by age. As expected, registration of congenital defect additions decreased rapidly with age. Almost 70 percent of them were added when they were 20 or under in age. Macular degeneration additions were made primarily when persons were old. Eighty-eight percent of them were over 60. Diabetic retinopathy additions also increased with age but not nearly so sharply as macular degeneration. Approximately 50 percent of them were over 60, and 88 percent were over 40. Abiotrophic chorioretinal disease and degenerative myopia additions were distributed more evenly by age. Every age group had more than 20 percent of the total. The 41–60 age group had the highest proportion of the total which was 37 percent.

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[4] Moorhead, Helen B. (Mrs.), "Causes of Blindness in 4,965 Persons Whom 14 States Added to Their MRA Register in 1966." *The Model Reporting Area for Blindness, Proceedings of the 1968 Conference.* U.S. Department of Health, Education, and Welfare, NIH, Bethesda, Md.

Figures 6 through 9 show the most common causes of blindness in each of the age groups.

According to figure 6, macular degeneration was the most frequent cause of blindness in the 2,790 additions in age group over 60. Cataract, glaucoma, and diabetic retinopathy were second, third, and fourth, respectively. These four causes blinded 77 percent of the additions whose age exceeded 60. These were also the four leading causes of blindness for all age groups combined. This is not surprising since the over 60 age group represented 54 percent of total additions for 1967.

It is seen in figure 7 that diabetic retinopathy was the most frequent cause of blindness in the 1,211 additions in the 41–60 age group. Cataract and glaucoma were second and third, respectively. Abiotrophic chorioretinal disease and degenerative myopia was fourth. These four causes blinded 58 percent of the additions in this age group.

Congenital defect is shown in figure 8 to be the most frequent cause of blindness in the 497 additions in the 21–40 age group. Abiotrophic chorioretinal disease and degenerative myopia was second. Diabetic retinopathy and optic nerve disease were third and fourth, respectively. Fifty-eight percent of this age group was blinded by these four causes.

Figure 9 shows that congenital defect was the most frequent cause of blindness in the 696 additions in the 21–40 age group. It blinded 51 percent of these additions. Abiotrophic chorioretinal disease and degenerative myopia was second. Retrolental fibroplasia and optic nerve disease were third and fourth, respectively.

Diabetic retinopathy and abiotrophic chorioretinal disease and degenerative myopia were the two causes of blindness which were among the four leading causes in three age groups. The former was a leading cause in age groups over 20. It ranked third in the age group 21–40, was the most frequent cause for age group 41–60, and was the fourth most frequent cause for additions with ages over 60. The latter, abiotrophic chorioretinal disease and degenerative myopia, was a leading cause in the age group of 60 and under. It was second in age group 21–40, fourth in age group 41–60, and second in the 0–20 age group.

Figure 10 reveals that the additions in 1966 were similar to those in 1967 in respect to causes of blindness. Macular degeneration blinded a smaller percent of total additions in 1967 than in 1966. Cataract and diabetic retinopathy also blinded smaller percentages in 1967. These declines in the percentages are explained partially by the fact that the over 60 age group in which these causes are important, dropped from 59 percent of total additions in 1966 to 54 percent in 1967.

Data on causes of blindness for additions in 1967 are not comparable with the data for additions for 1965 for two reasons. First, the clinical groupings for the 2 years are not the same. Second, NINDB reviewed only a small sample of the State assigned classifications of causes of blindness and accepted the State classifications for the remainder, whereas virtually all of the additions for 1967 were classified for cause of blindness by the National Eye Institute.

The distribution of causes of blindness in the additions for 1967 also cannot be compared with the distribution of causes in the total number of persons in registers on December 31, 1967. The classification of causes of blindness by the States was not reviewed by NINDB for additions before 1965. Also, many of the additions to registers before 1962 have not been classified for cause of blindness. Even if all the persons in registers were classified for cause of blindness exactly as the additions during the year were classified, the distributions would not be comparable for various reasons. For example, the age distribution for total in register is weighted less toward higher ages than the additions during the year. The older additions are removed sooner from registers because their life expectancy is shorter. Only about 50 percent of the persons in MRA registers on December 31 were over 60 years of age, whereas 54 percent of the additions in 1967 were older than 60. Throughout this paper it has been shown that causes of blindness have distributions which differ significantly by age of person.

FREQUENCY OF THE CAUSES OF BLINDNESS IN
5,443 ADDITIONS TO MRA REGISTERS IN 1967

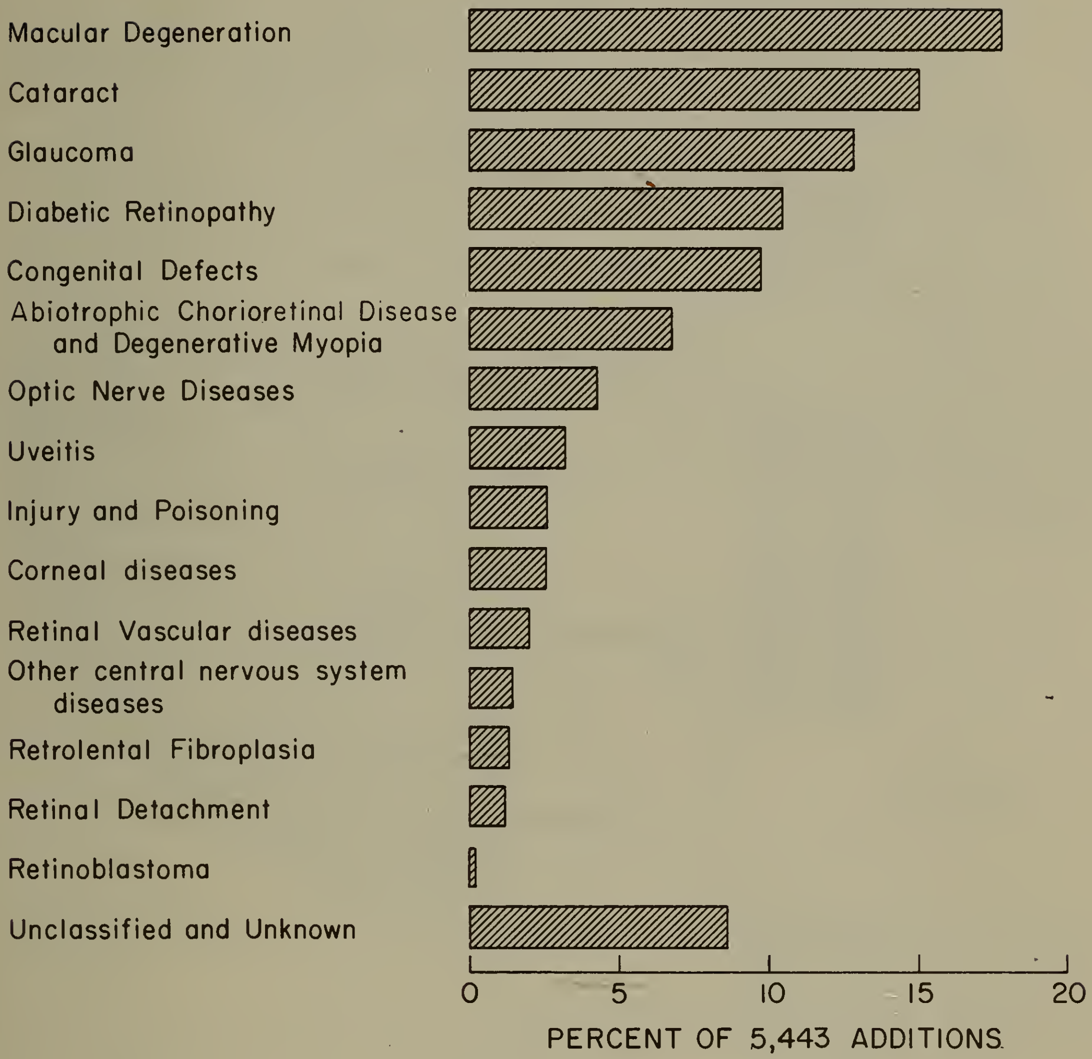


Figure 1

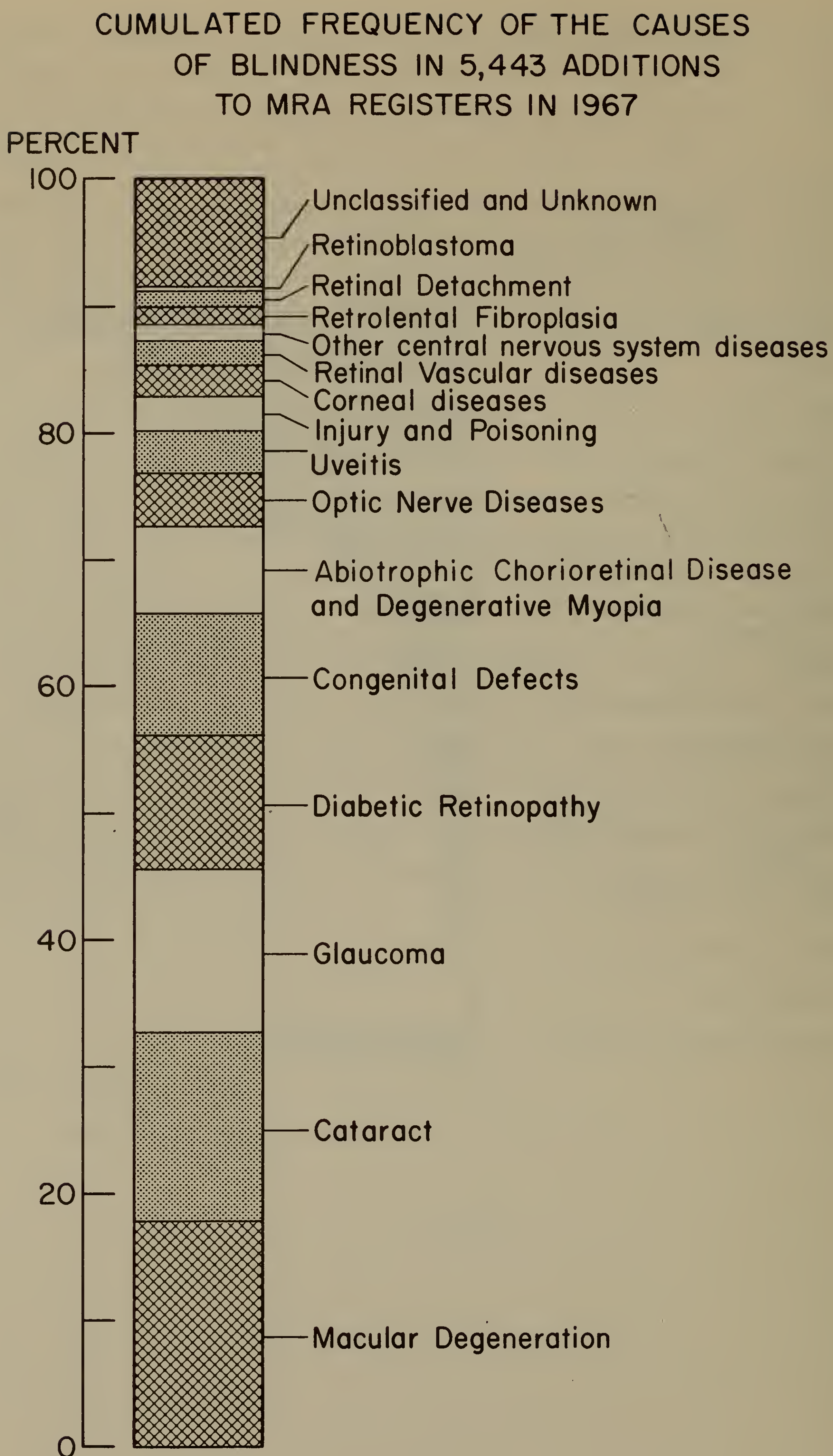

CUMULATED FREQUENCY OF THE CAUSES OF BLINDNESS IN 5,443 ADDITIONS TO MRA REGISTERS IN 1967

Figure 2

FREQUENCY OF PERSONS BY AGE GROUPS
IN 5,194 ADDITIONS TO MRA REGISTERS
IN 1967 WITH KNOWN AGES

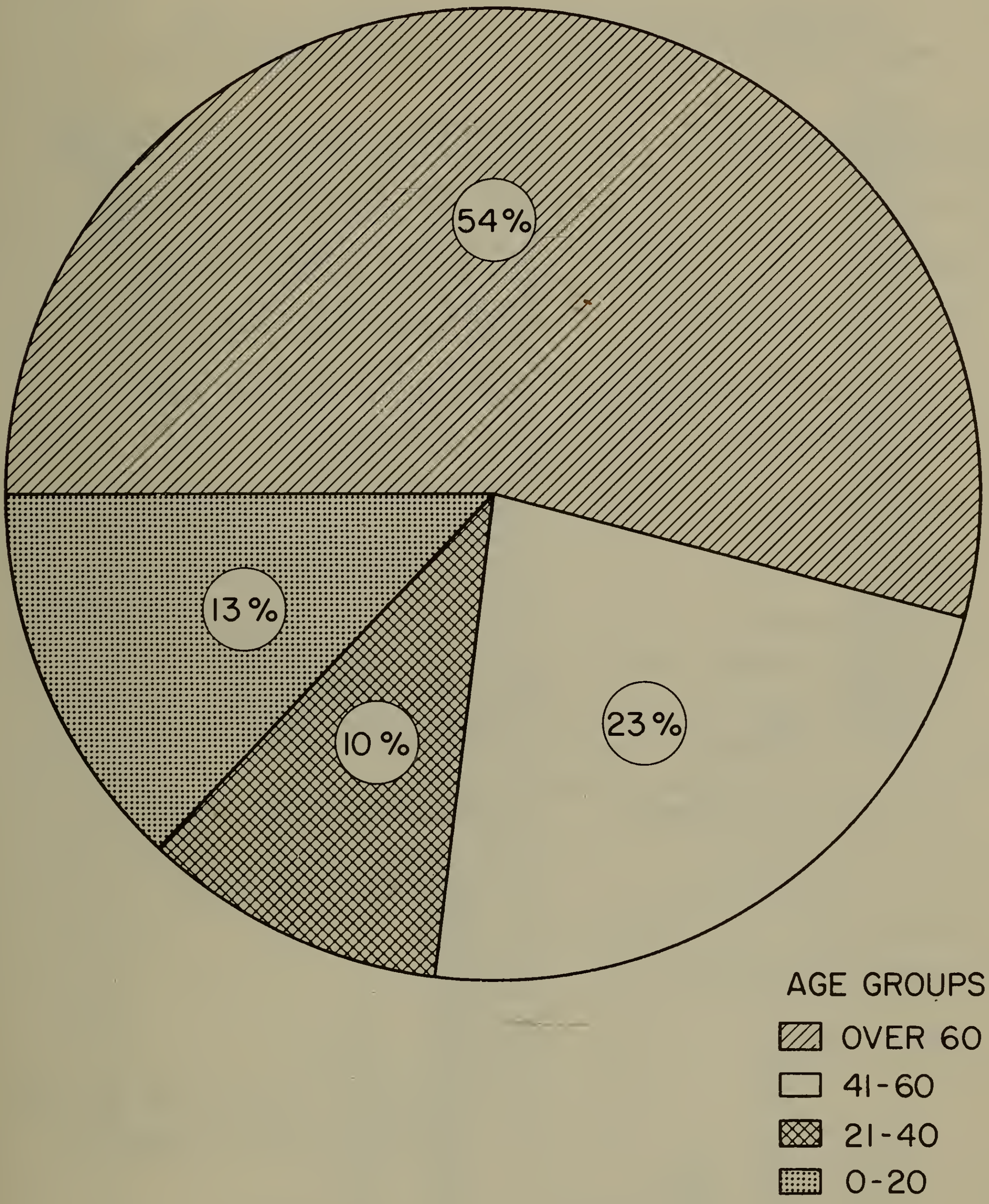
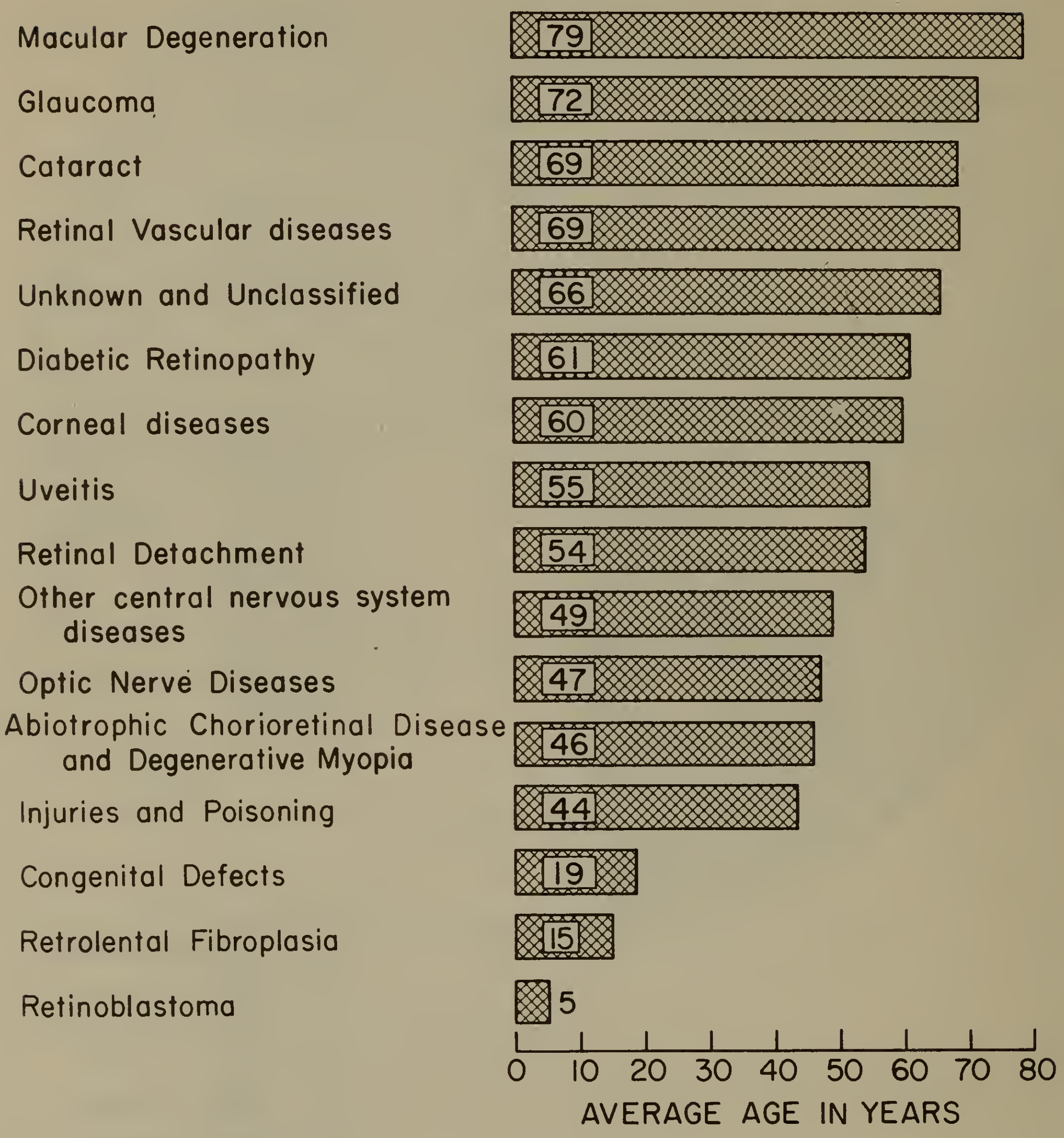


Figure 3



AVERAGE AGE BY CAUSE OF BLINDNESS IN 5,194 ADDITIONS OF KNOWN AGE TO MRA REGISTERS IN 1967

Figure 4

FREQUENCY OF SELECTED CAUSES OF BLINDNESS
BY AGE GROUPS IN ADDITIONS
TO MRA REGISTERS IN 1967

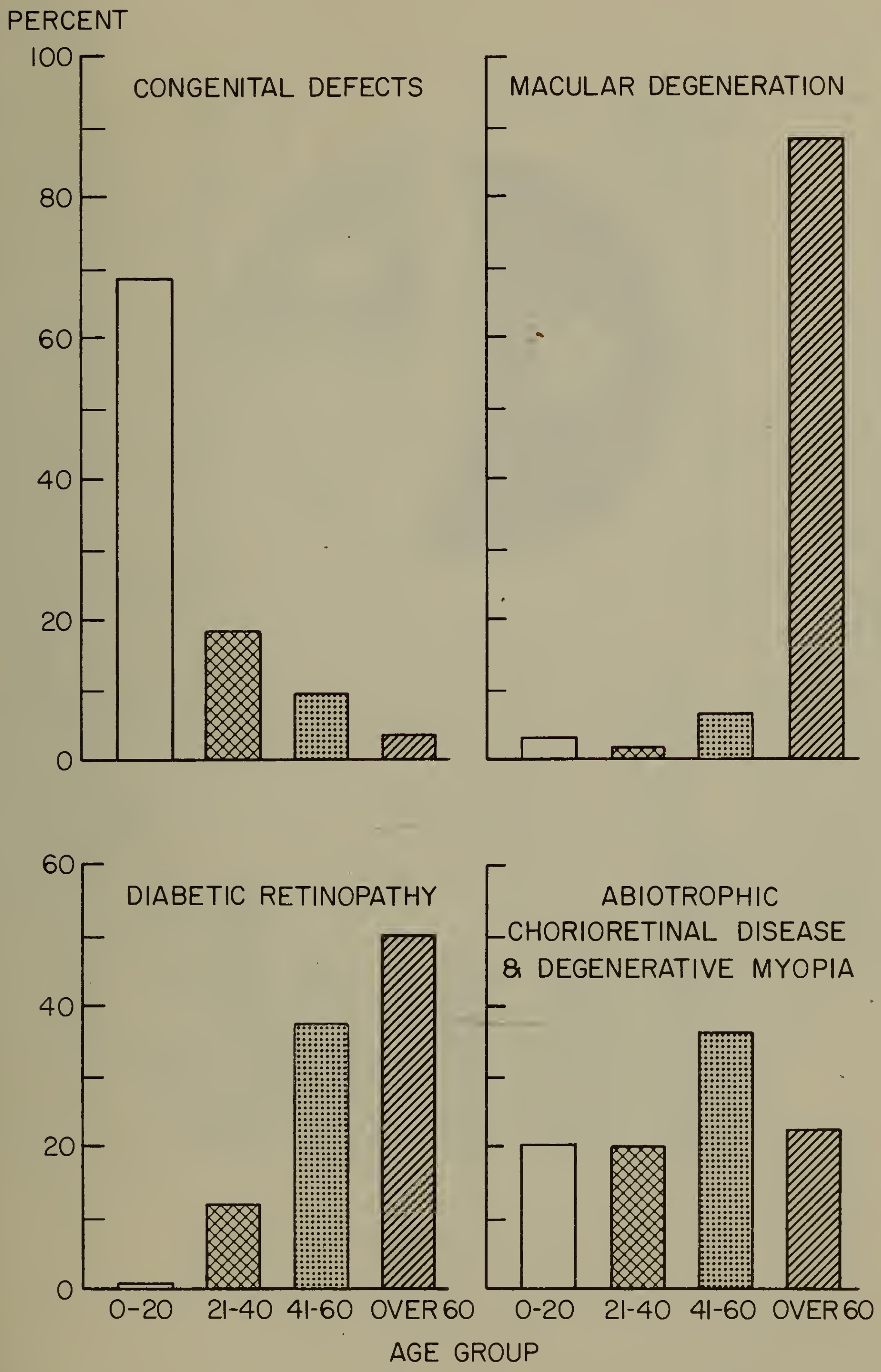


Figure 5

MOST FREQUENT CAUSES OF BLINDNESS IN 2,790 ADDITIONS TO MRA REGISTERS IN 1967 WHO WERE THEN IN AGE GROUP OVER 60

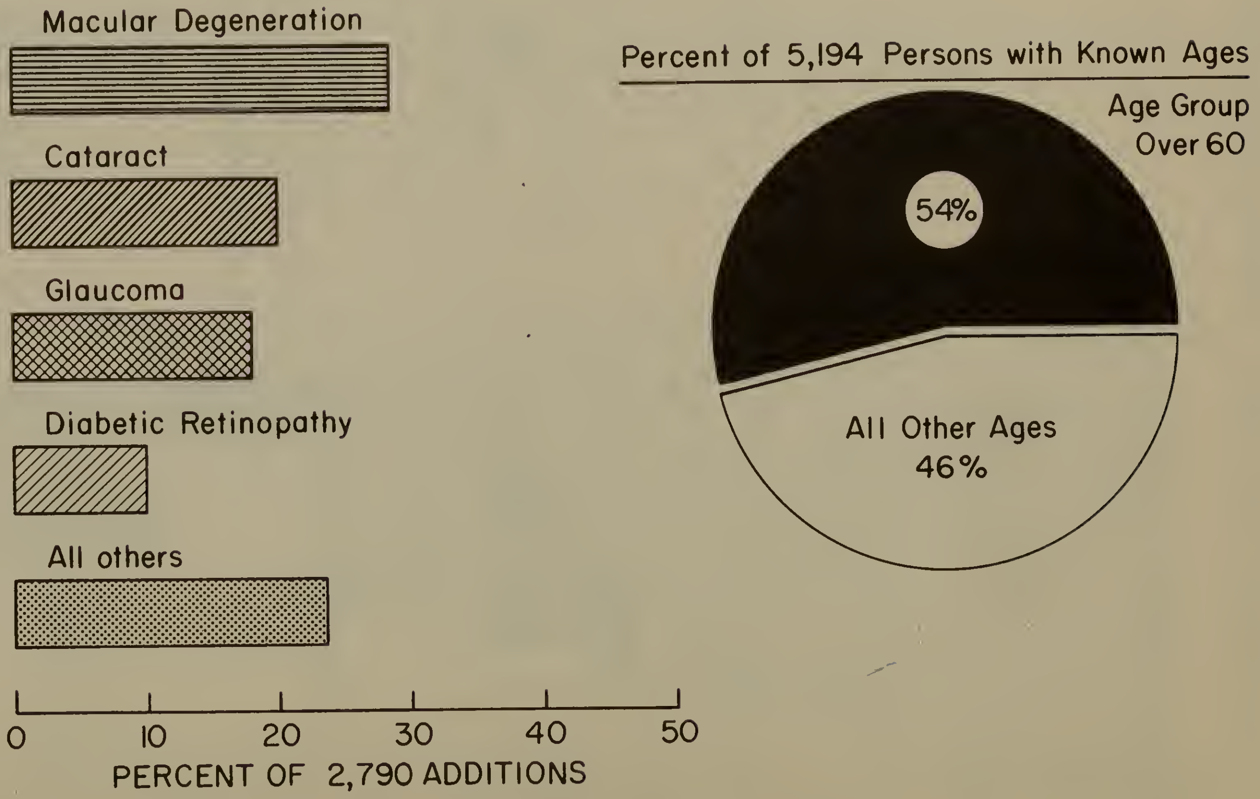


Figure 6

MOST FREQUENT CAUSES OF BLINDNESS IN 1,211 ADDITIONS TO MRA REGISTERS IN 1967 WHO WERE THEN IN AGE GROUP 41-60

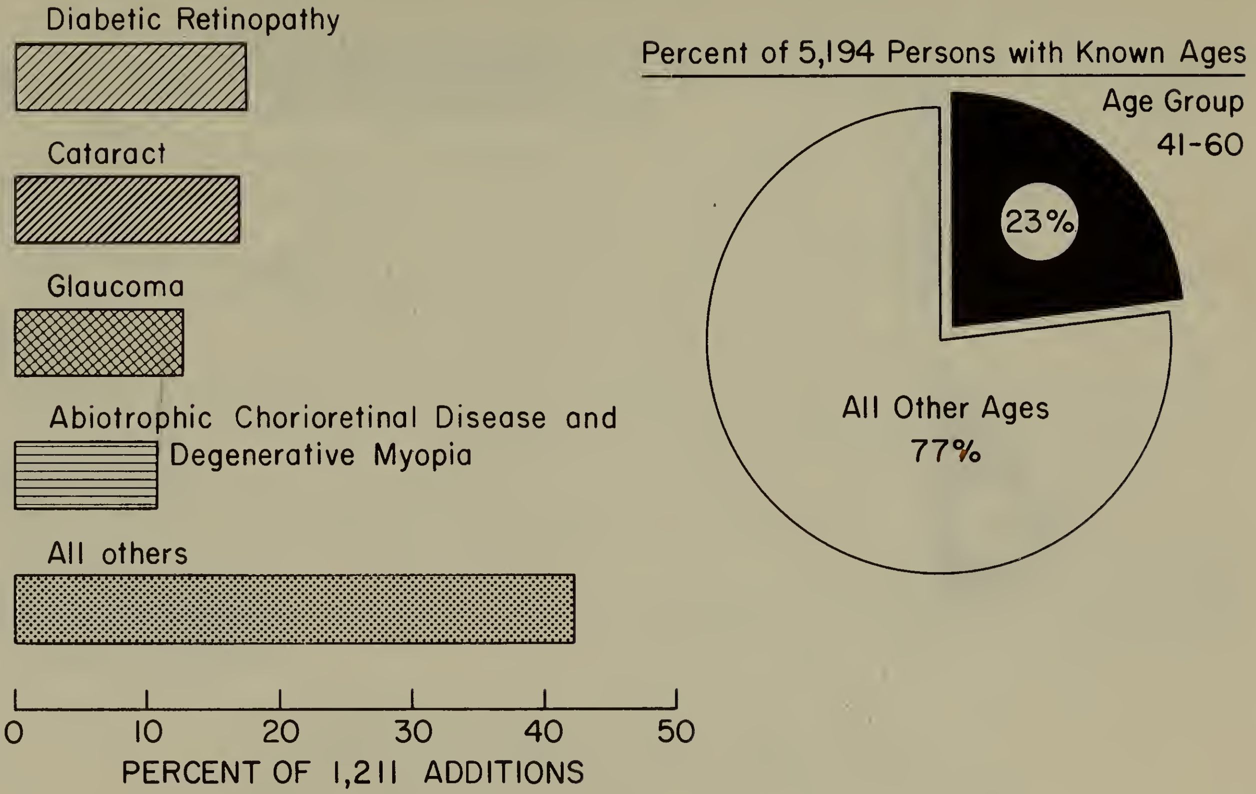


Figure 7

MOST FREQUENT CAUSES OF BLINDNESS IN 497 ADDITIONS TO MRA REGISTERS IN 1967 WHO WERE THEN IN AGE GROUP 21-40

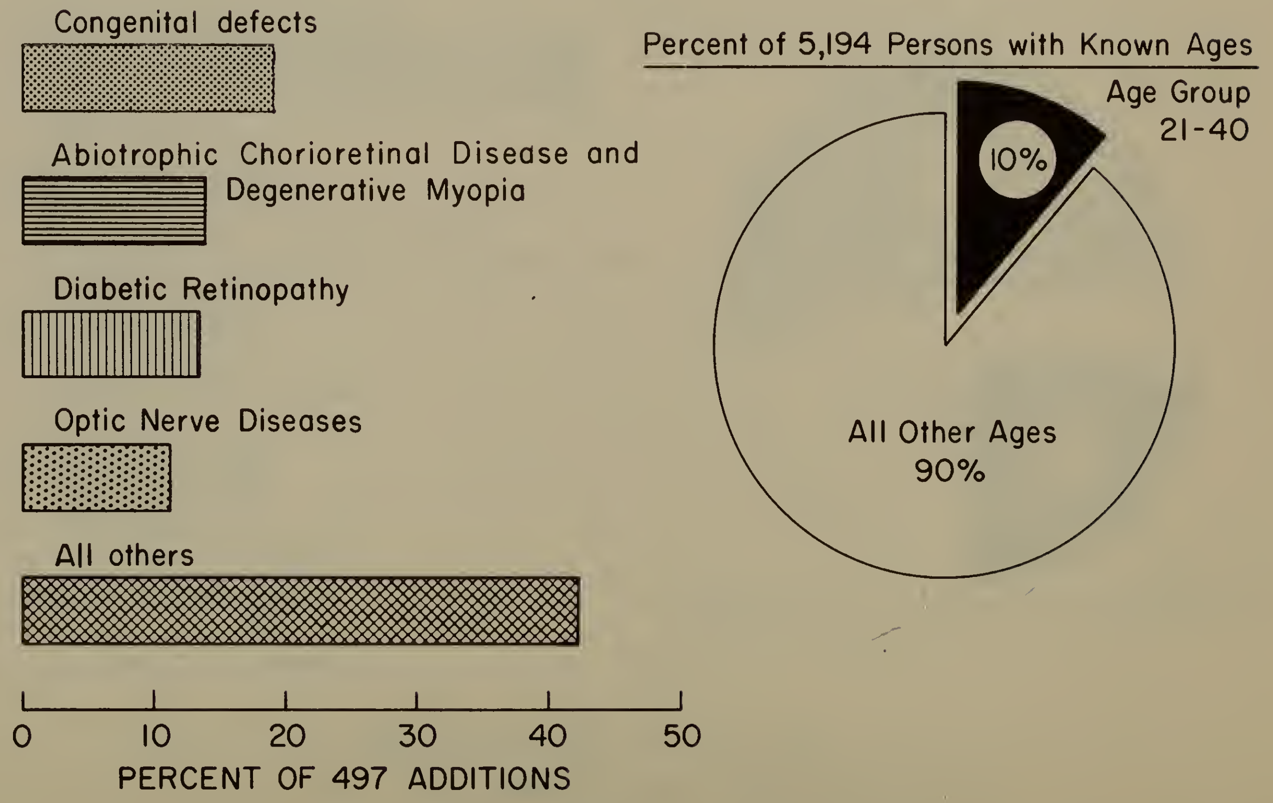


Figure 8

MOST FREQUENT CAUSES OF BLINDNESS IN 696 ADDITIONS TO MRA REGISTERS IN 1967 WHO WERE THEN IN AGE GROUP 0-20

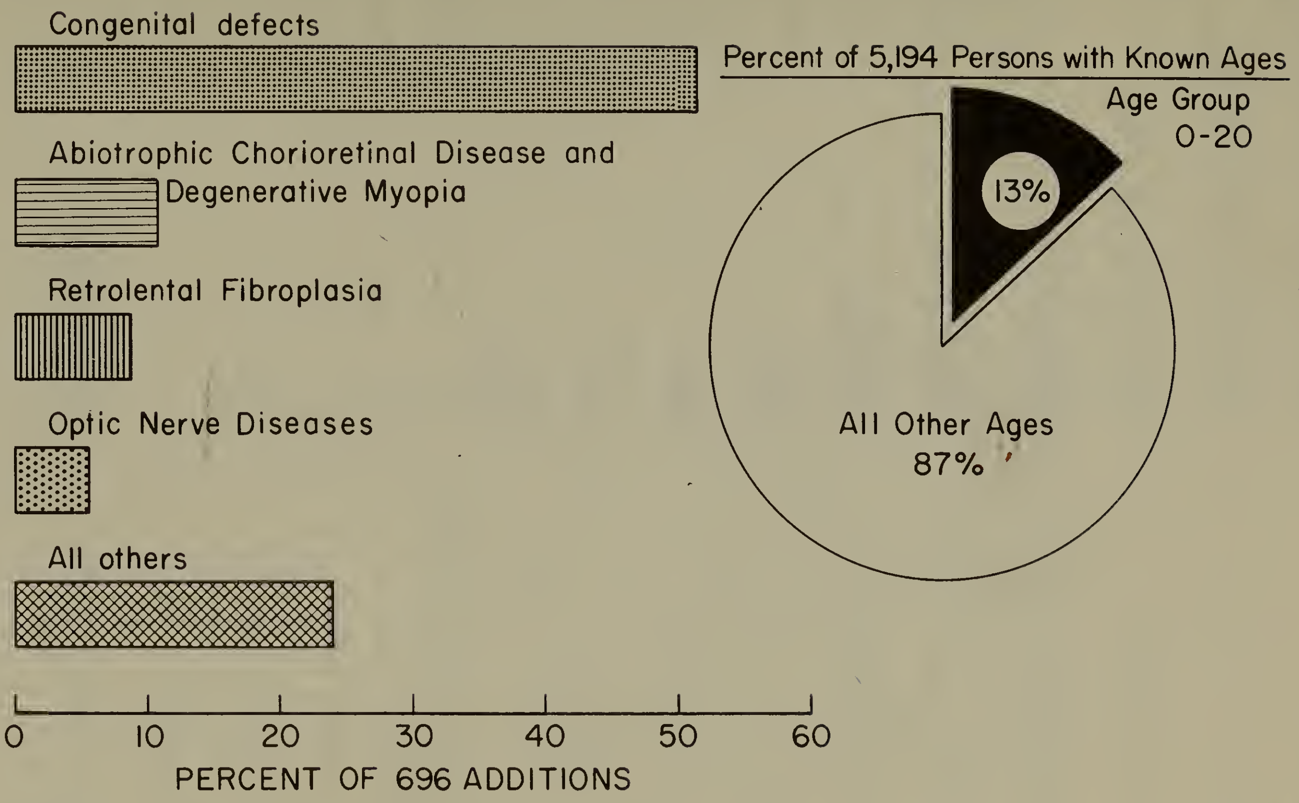


Figure 9

FREQUENCY OF CAUSES OF BLINDNESS FOR
ADDITIONS TO MRA REGISTERS IN 1966 AND 1967

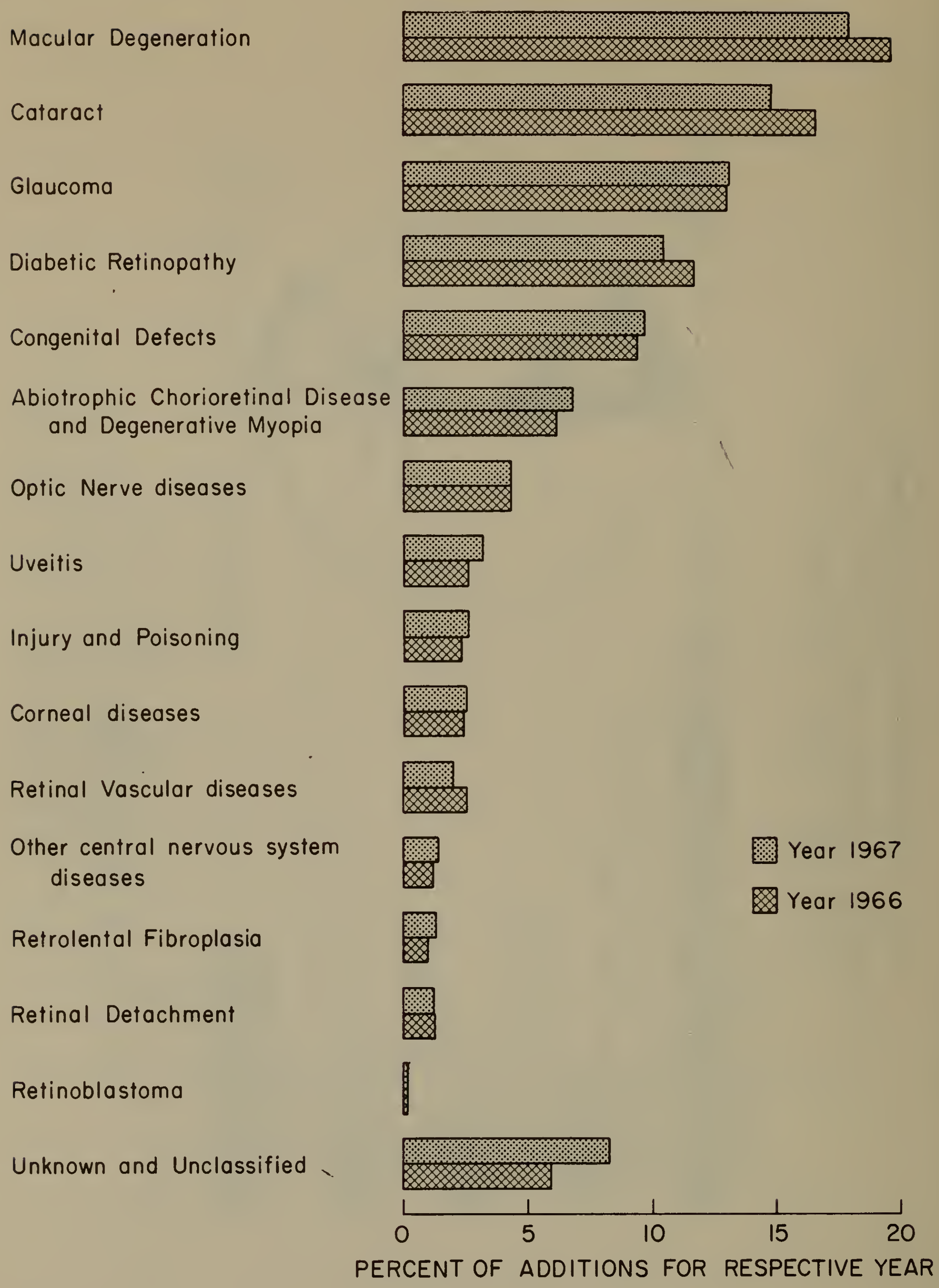


Figure 10

NEW CONCEPTS OF OXYGEN AND RETROLENTAL FIBROPLASIA

ARNALL PATZ, M.D.[1]

RETROLENTAL FIBROPLASIA (RLF) was first identified in 1942. Within a few years RLF became one of the larger causes of infant blindness. In the United States, RLF cases exceeded the total of all other causes of child blindness combined. The identification of oxygen over-use as the specific cause of RLF in the early 1950's led to a general curtailment of oxygen therapy in the premature nursery and a dramatic drop in RLF incidence resulted. In the early- and mid-1960's significant changes in oxygen therapy for small premature infants have been introduced as pediatricians have come to recognize the high mortality from pulmonary diseases, especially the idiopathic respiratory distress syndrome. Since approximately 40,000 premature infants in this country yearly are afflicted with the respiratory distress syndrome, the pediatrician is frequently faced with the dilemma of too much oxygen causing blindness and too little oxygen causing death or brain damage.

The pediatrician's usual indication for oxygen therapy is the presence of cyanosis or respiratory difficulty. The criterion of cyanosis versus a normal pink color has only limited application. While the infant is cyanotic, the blue color is a reasonably reliable indicator of low arterial oxygen tension (PO_2) and indicates an obvious need for added oxygen. As the oxygen tension rises, hemoglobin becomes saturated with oxygen to give the infant a pink color. It is unfortunate, however, that because of the flattening the S-shaped hemoglobin saturation curve, further increases of arterial oxygen tension cause very little change in the infant's color. An infant with a pink color may have an arterial PO_2 of 100 mm., which appears safe for the retina, whereas the same infant has no significant change in his pink color with a PO_2 of 300 mm., which would be injurious to the retina. Frequent sampling of the arterial blood oxygen levels provide the only means now available to prevent these potentially retino-toxic oxygen levels. Arterial oxygen monitoring requires a highly sophisticated pediatric team to collect an arterial blood sample from a small premature infant and the gas analysis requires skilled technical personnel and expensive instrumentation. As a result, only a relatively small number of hospitals in this country are equipped to monitor arterial oxygen tension and the majority of the premature infants in this country receive oxygen therapy without the safeguard of arterial PO_2 measurements.

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[1] Wilmer Ophthalmological Institute, The Johns Hopkins Hospital and University, Baltimore, Md.

Our early nursery studies demonstrated that severe retinal vasospasm occurred in our nursery study where infants received prolonged high oxygen concentration. These studies suggest that ophthalmoscopic monitoring of the retinal vessel caliber can be an indicator of oxygen overusage. It is, therefore, recommended that ophthalmoscopic examination be performed on infants receiving significant amounts of oxygen, especially when arterial PO_2 monitoring facilities are unavailable.

Further research is urgently needed to give the pediatrician better guidelines for safe oxygen administration to the premature infant. Special studies should be directed toward defining the precise safe level of arterial oxygen tension that can be maintained without damage to the retina. There is a major need for improved methods of evaluating the infant's state of oxygenation. These methods should be reasonably accurate and permit general usage for the majority of hospitals.

A significant number of new cases of retrolental fibroplasia have been reported during the past 3 years in the United States. Hopefully, through the development of improved monitoring of the infant and by the cooperation of the ophthalmologist, oxygen can be administered with a minimal risk of blindness.

The studies discussed in this paper were supported by grants from the U.S. Public Health Service, National Institutes of Health—NB–02198.

LOW VISION AIDS FOR THE PARTIALLY SIGHTED (VISUALLY HANDICAPPED)

GEORGE M. MILKIE, O.D. F.A.A.O.[1]

DURING THE past decade there has been a growing awareness and interest in the possible ways of bringing useful vision to more and more partially sighted persons. Even hopeless persons can be helped in seven out of 10 cases—despite the fact that numerous causes are responsible for blindness and reduced vision throughout the span of a person's life. Previous speakers have elaborated fully upon this causality, and I am sure that all here, today, know of science's varying abilities and limitations in affecting these determinants. However, let us see what can be done to help those whose vision has already been affected.

Legally Blind

According to the accepted definition of blindness, a person is considered legally blind if he has central visual acuity of 20/200 or less (with best possible correction); he may also be considered legally blind even though central visual acuity is more than 20/200 if there is a field defect—when the peripheral field has contracted to such an extent that the widest diameter subtends an angular distance of no greater than 20°.

This definition of blindness contains, however, an important omission in its failure to consider the importance of near or reading vision. Within the peripheral field, defects which do not result in a contraction of the field itself but block out certain areas (scotomas) are also a vital consideration.

In most cases visual acuity is used as an indication of the person's degree of sight. Such a test, however, does not always give a true indication of the individual's visual efficiency—his ability to perform the undemanding visual tasks essential to his everyday pattern of living.

For example, the partially sighted patient often reveals a much greater visual competence at the reading distance than their designation as legally blind would suggest. Research reveals there is no substantial correlation between the near and far point vision of the visually handicapped patient.

The importance of visual efficiency as contrasted to visual acuity has been emphasized by many professionals working in this area of specialization.

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[1] Program Director, American Optometric Association.

The work of numerous researchers collaborate the fact that many children and adults alike with very low vision make much better use of their vision than others having a higher visual acuity. Factors such as general intelligence and environmental influences seem to be substantially influential.

Partially Sighted

Where does partially sighted (subnormal) vision begin? According to the Dictionary of Visual Science,[2] subnormal (partially sighted) vision is defined as:

> "* * * vision conisdered to be inferior to normal vision, as represented by accepted standards of acuity, field of vision, or motility and uncorrectable by conventional lenses. The branch of visual care identified with its correction or rehabilitation by special aids or techniques."

Thus the term suggests a relative measurement. As applied, its meaning varies over a wide range.

In our Armed Forces, visual acuity of less than 20/200 may be unacceptable. Drivers of automobiles must demonstrate 20/40 acuity for distance in order to obtain licenses in most States. However, deviations of more than 30 percent are seldom referred to as partially sighted vision.

Forgotten People

Throughout ophthalmic literature, the connotation "partially sighted" or "subnormal vision" has more frequently referred to visual acuity ranging from 20/200 (legal blindness) to as low as light perception.

There is another group and a very large one which deserves consideration. It is made up of the population whose vision for distance and/or near is less than 20/60 and yet not reduced to 20/200. These patients occasionally are referred to as forgotten people. Their visual loss is not so great as to suggest special optical aids and yet conventional prescription lenses are inadequate for them. Patients demonstrating visual acuity that is declining as a result of any cause may well fall into this category. However, the forgotten people are not necessarily our concern in today's discussion.

As many as 80 percent of partially sighted patients respond favorably to low vision corrections and aids. Debilities, nonocular in origin, as an example, a mentally retarded patient or associated condition such as poor reading, can generally be enhanced—surprisingly—in many instances when low vision aids are utilized.

If a person is considered partially blind, he is also considered partially sighted. The emphasis on sight, however little, must be stressed and encouragement must be given to enable this patient to become and remain active and independent in body and mind. This applies to all patients irrespective of whether they are afflicted in childhood, middle age, or during old age.

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[2] Dictionary of Visual Science by Schapero, Cline & Hofstetter, Chilton Co., 1968.

Interprofessional Consultation

Numerous statistical surveys published over the past two or three decades have dealt with the corrections prescribed for the many conditions resulting in a visual handicap. The conclusions drawn show a definite trend towards professional practice limited to helping the partially sighted; a specialization which is most significant in today's society.

The surveys clearly demonstrate that the sight of a very large portion of low visual acuity patients can indeed be effectively improved, and also that many people classified as legally blind can be visually rehabilitated through the use of special correction(s). Even a small vision improvement may appear miraculous to a patient burdened with the official social stigma attached to the loss of sight—legally blind. It soon becomes apparent that the provision of special optical and ophthalmic aids is a most worthwhile service to all—the patient, the community, the State and even the Nation.

Should the visual loss be long standing, the patient may fall into the pattern of acting like a blind person and may well adapt to his role. With such adaptations he may lose all motivation to learn or even to read again. The patient may fear losing the sympathetic attention and preferred treatment accorded him by family and friends. In cases where a patient has rejected a potentially helpful aid in the past, there is often evidence of a deeply rooted emotional disturbance. For this reason there is an important need for the doctor (optometry or medicine) to work closely with social service workers, psychologists and other professionals to assist the patient in adapting. To help him make the necessary adjustment in accepting his new visual role.

Rehabilitation involves the need to consult interprofessionally as well as intraprofessionally. Optometrists, psychologists, educators, physicians, social workers, surgeons, and other professionals must all work hand in hand in order to achieve the maximum results for any particular patient. Even in prescribing for patients with active pathology, the decision to acquire and use a low-vision aid must be of an interprofessional nature although responsibility for the decision must rest primarily with the doctor treating the cause or disease.

When fitting low-vision aids, the optometrist or ophthalmologist practicing within this area of specialization must be well equipped with a refined knowledge in pathology, psychology, sociology, and optics. Therefore, he cannot relegate the task of fitting low-vision aids to those not so experienced.

There are many significant observations to consider in the prescribing of low-vision aids. Some of these are: Diagnosis, prognosis, duration of ocular pathology, patient's present visual status, educational history, types of visual aids formerly prescribed or now in use, evaluation of the aid(s), vocational endeavors and aspirations and the psychological factors related to his reaction to the handicapped. As a result of these needs, this phase of rehabilitation service cannot be relegated to a technician if maximum success is to be achieved.

An Infinite Variety

A low-reflectance reading shield with a split in it was first described in 1897 by an optometrist, Charles F. Prentice. He named the device "Typoscope." Patients not able to read with corrective lenses alone could do so with the aid of the Typoscope. It takes a great number of optical aids in order to provide each patient with the one that best meets his particular needs. This simple device described over 70 years ago by Prentice for example is virtually unknown, today, in many optometric and ophthalmological practices.

The visual-optical aids as well as nonoptical aids we have today at our disposal comprise an almost endless list. There are hand-held, stand-fixed or head-borne types of appliances along with enlarged printed matter, talking books and the simple Typoscope. Together these aids offer a nearly infinite variety of possibilities. There is a place for every piece of equipment that can be made available.

Generally speaking, a unit that can be worn in a spectacle frame is preferred over other types because it has the advantage of leaving the hands free and is capable of being held reasonably steady. However, there is no doubt the hand magnifier has its uses as do stand magnifiers.

Most doctors insist that visual aids be light in weight and provide reasonable optical performance. Interchangeability of aids is imperative. Insisting on these factors gives the practitioner much freedom— freedom to allow the patient to learn with one aid when ultimately something quite different is to be supplied and freedom to alter the correction as the condition progresses. With children the practitioner is allowed freedom to retain the aid as the patient's physical features change. There is also the freedom of rewarding the patient by decreasing the power of the aid as his facility with the units improves performance.

Having decided a patient may be benefited by correction through low-vision aids, the doctor must then determine—by a careful and thorough examination and evaluation—which of the aids he will prescribe. The function of all low-vision aids is to provide an enlarged retinal stimulus pattern and call into play more nerve receptors. (See fig. 1.) As a natural consequence of this effect, the prescribing doctor can expect improved vision through an increase in the patient's visual efficiency. A happy note comes in actual practice where we often find the patient's improvement in visual efficiency to be considerably greater than anticipated.

Types of Aids

Let us now consider the major types of visual-optical-nonoptical aids for the partially sighted, giving particular attention to their distinctive

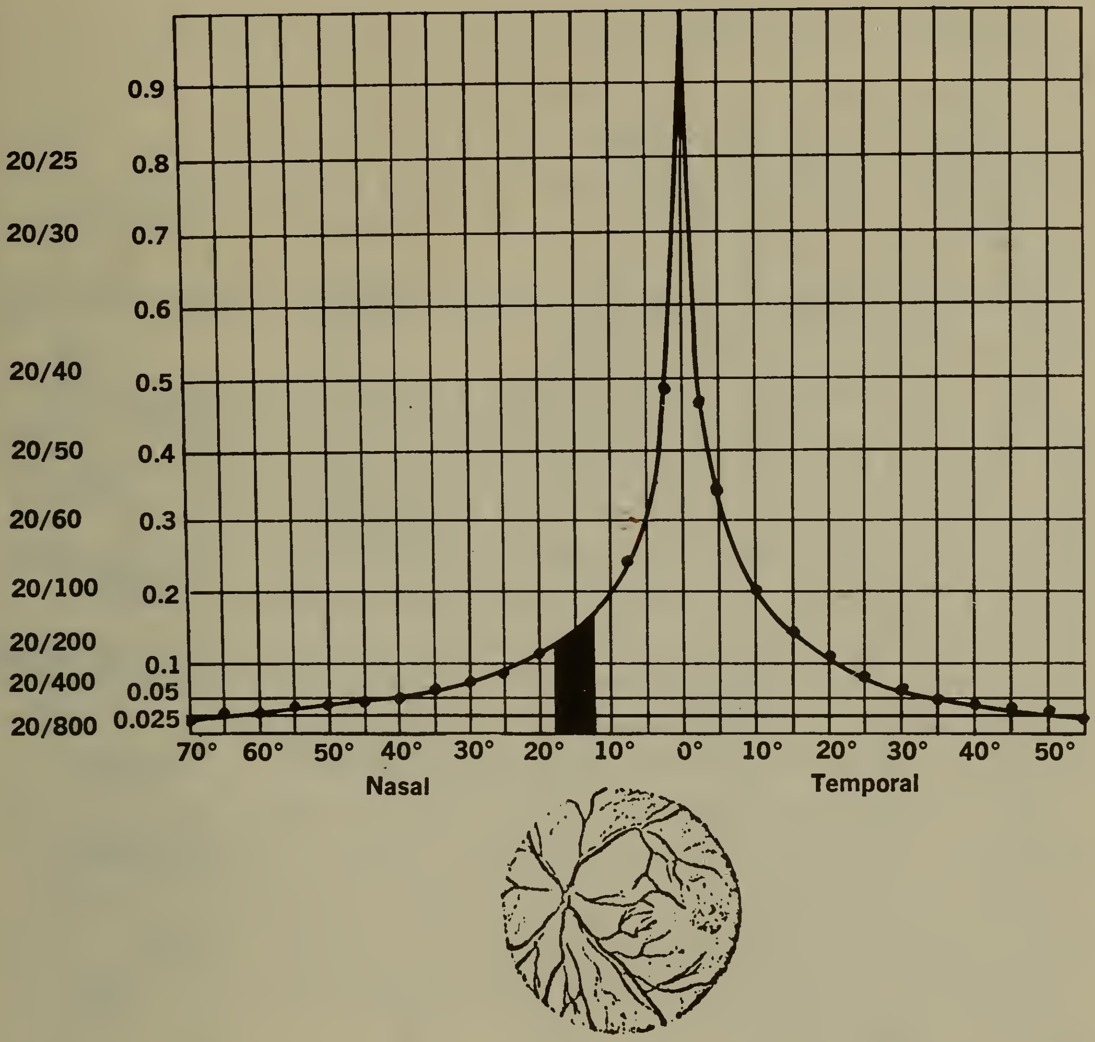


FIGURE 1.—Different degrees of vision in relation to the fovea, optic disc and peripheral retina. From Linsz, A.: Physiology of the Eye, vol. 2, Grune and Stratton, Inc., New York, 1952.

characteristics as well as their effectiveness in relation to the visual and psychological requirements of the patient.

Non-head-borne Aids

In first categories of this classification there are a great number and variety of magnifying devices available. They include: Hand-held magnifying devices—illuminated and nonilluminated; stand magnifying devices—illuminated and nonilluminated, both the focusable and nonfocusable types. A simple paperweight magnifier is also included here.

These devices have a useful field of between 10° to 15° and produce a magnification of 8 × to 12 ×.

Magnifiers mounted on stands relieve the patient from the necessity of the precise focusing usually required of head-borne devices. Where hand tremor is present this may be a deciding factor as to the device of choice. With the use of these devices, better illumination of the reading material is frequently possible and to a small number of patients they have been found to be very satisfactory.

As explained previously, the importance of the psychological factors primary in the fitting of low-vision aids, the patient whose visual loss is of a recent origin may be completely unprepared to accept his visual limitations. He will often be contented to learn to use the strong lens of a hand magnifier as an interim correction. Later as he becomes more experienced with this aid, he is usually more acceptable to the head-borne device.

The disadvantage of utilization is they rarely give benefit to patients with less than 20/200 visual acuity.

Projection magnifiers usually require a viewing distance of approximately 14 inches. The projection magnifying devices are unique because they require fewer precise adaptations of the patient. These devices are simply opaque projectors similar to the conventional lecture type. The restriction of fields at the higher magnification as well as the problems of adequate illumination can be partly overcome by utilizing these devices. After adequate practice the patient is able to read in a relaxed manner at a comfortable reading distance. The patient is usually limited if he attempts to use the conventional lecture type of projector—for as he approaches the screen he blocks the projected light.

There are two types in use: (1) The AO (no longer made but still utilized), is useful for patients with 15/200 vision or better producing a 3 × to 5 × magnification. (2) The Megascope is useful for vision as low as 3/200 with a produced magnification of 12 × or 20 ×.

Monocular and binocular field glasses are available in 3 × to 6 × prism telescope forms.

A simple high plus lens held inches from the uncorrected eye also yields increased magnification.

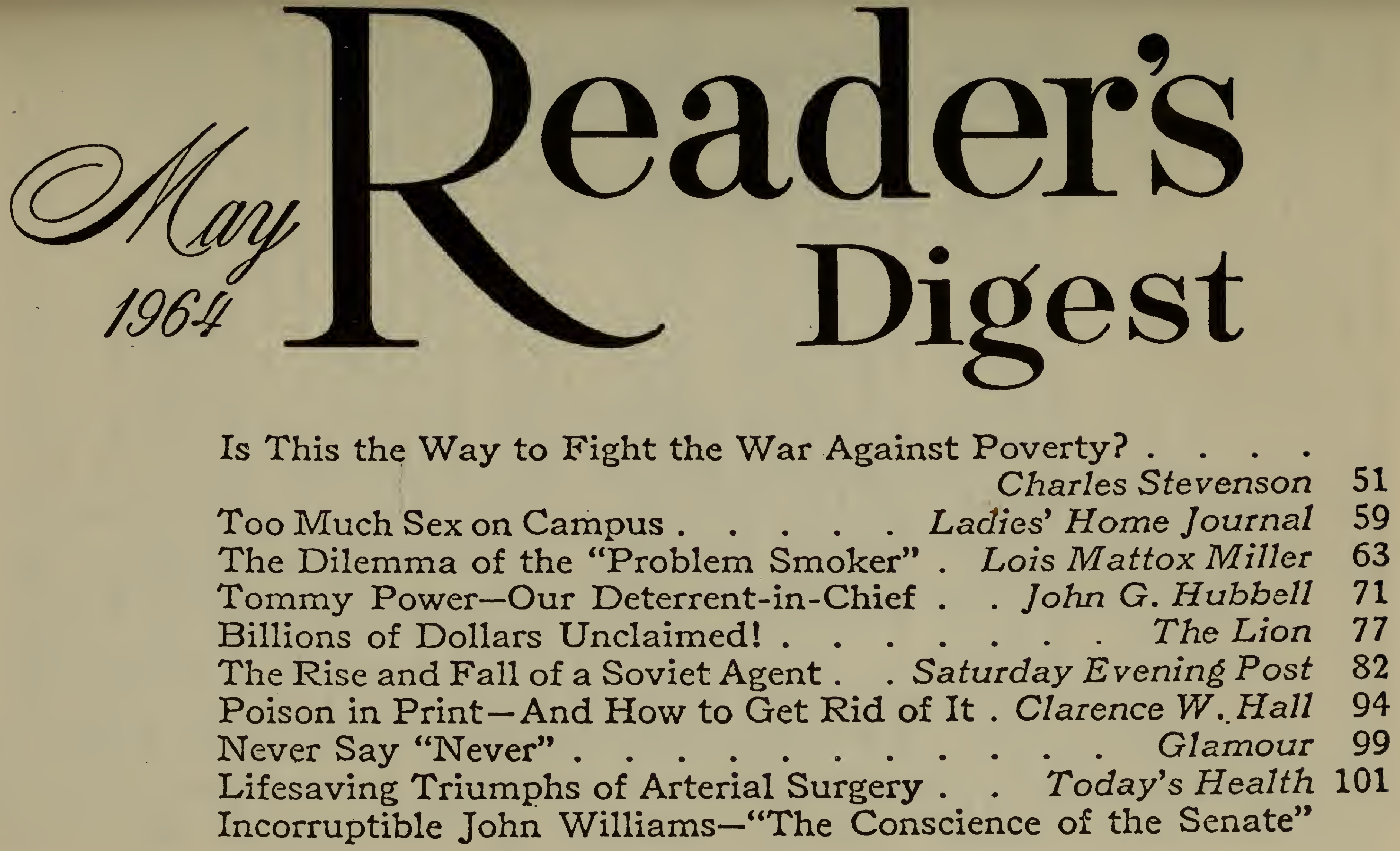
Talking books have been elaborated upon numerous times during this and other MRA conferences.

Enlarged print or large type publications have been a "boon" to the partially sighted population. Publishers are producing a growing list of books and periodicals with type more than double customary size.

The enlarged type Reader's Digest (see fig. 2) came into existence in 1963. This was the first commercial large-type publishing venture. The entire monthly magazine—except for advertisements—is produced and enlarged.

Today over 900 enlarged-type books are published, including editions of the classics, modern novels, poetry, dictionaries, encyclopedias, cook books, and religious material as well as educational text books and materials.

As more publishers recognize the large audience for these materials and improved technology brings down production cost—even a greater number of books and periodicals will become available to the partially sighted.



May 1964

Reader's Digest

Is This the Way to Fight the War Against Poverty? . . . . Charles Stevenson 51
Too Much Sex on Campus . . . . . Ladies' Home Journal 59
The Dilemma of the "Problem Smoker" . Lois Mattox Miller 63
Tommy Power—Our Deterrent-in-Chief . . John G. Hubbell 71
Billions of Dollars Unclaimed! . . . . The Lion 77
The Rise and Fall of a Soviet Agent . . Saturday Evening Post 82
Poison in Print—And How to Get Rid of It . Clarence W. Hall 94
Never Say "Never" . . . . Glamour 99
Lifesaving Triumphs of Arterial Surgery . . Today's Health 101
Incorruptible John Williams—"The Conscience of the Senate"

FIGURE 2.—Enlarged edition of Reader's Digest.

Many additional aging persons would enjoy having reading matter printed in larger type, even though it is not actually required. A market research study conducted by Xerox Corp. reports that this number may range up to 10 million. Xerography offers an infinite reproduction of large edition books, manuscripts, periodicals, etc. (See fig. 3.)

The Typoscope as referred to previously is an adjustable reading shield placed on reading material to exclude extraneous light. It acts as place-locator or frame when fixation is poor. A recent development embodies built-in lighting unit, to provide even and controlled illumination.

Head-borne aids

Lenses for distance vision seldom present a special problem as strong plus and minus lenses are usually ground to be cosmetically acceptable. High minus lenses are usually ground with a plano or near plano outside curve and high plus lenses are usually ground in the biconcave form. (See fig. 4.)

The strong convex lens are produced as small as possible or in lenticular glass, lenticular plastic, or aspheric lenticular (see figs. 6 and 7) form. Bifocals may be obtained in lenticular aspheric glass and plastic lenses. These are not considered microscopic lenses because of the simple lens design, however, they have the added advantage of a larger more effective field of view. The decreased edge thickness also makes these lenses less conspicuous and lighter in weight.

Very high minus lenses are usually ground in a myodisc form. (See fig. 5.) These are also usually cosmetically more acceptable with no limitations of size or shape of the lens being necessary.

Conventional Spectacles

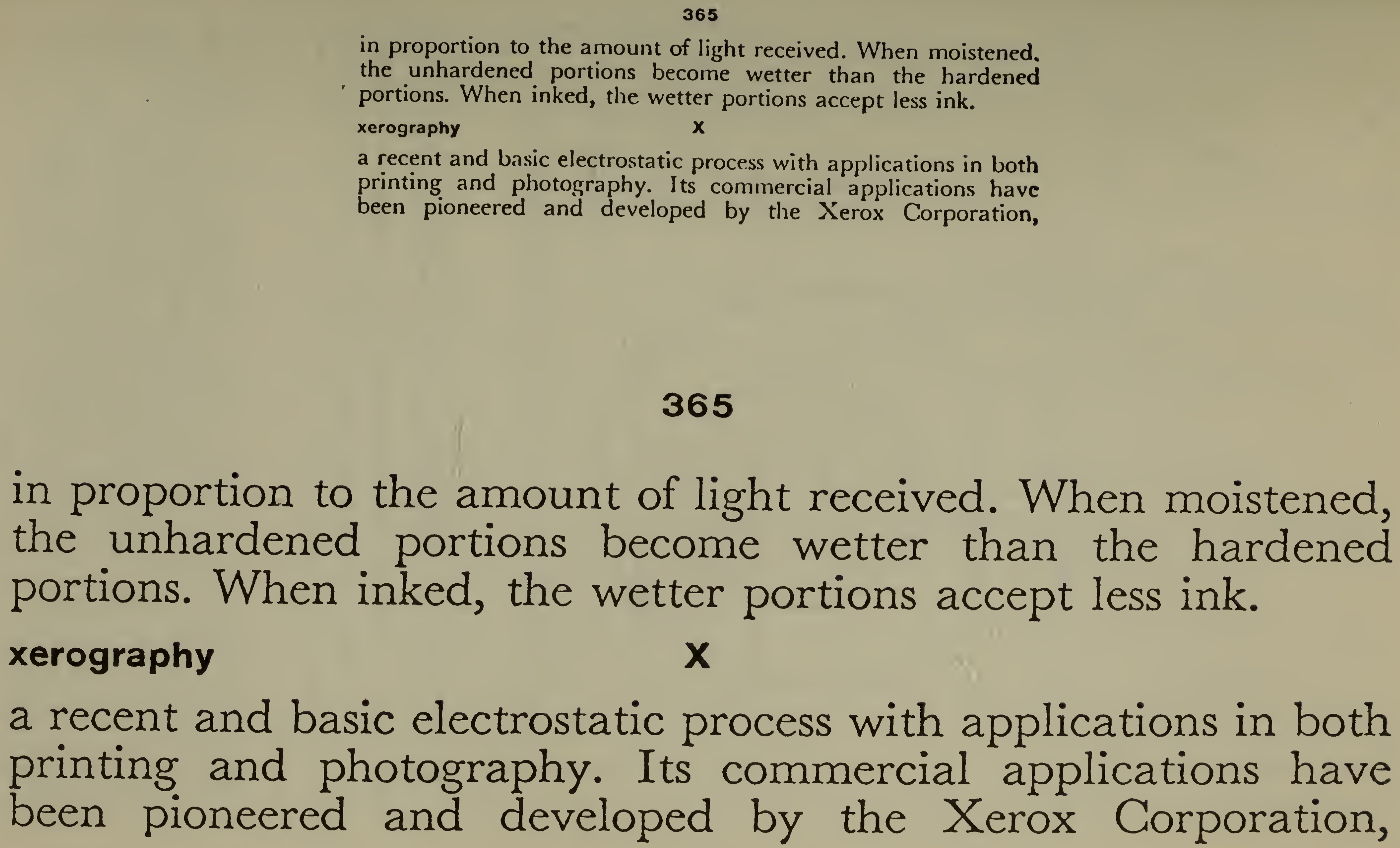
Conventional spectacles with high reading additions can be of help to many patients. The weakest prescription usually satisfies the purposes for which these lenses are utilized.

A high percentage of patients readily adapt to high plus lenses.

Like other low-vision aids these demand careful guidance in their use. Patients must be instructed to hold the reading material quite close to their eyes in order to see within the focal length of the lens. The combination of a close fixation distance and a very narrow field of view makes it necessary to emphasize to the patient the importance of a good light source properly directed. The stronger the correction the closer the material must be held and the more limited the field of vision.

The quality and texture of the paper, the contrast and sharpness of the printing are also significant factors in determining the effect of this particular visual aid. The final test is usually not on a reading chart but on actual material of interest—magazines, newspapers, music, textbooks, telephone directories, etc.

There is an advantage of simplicity, economy, and conventional appearance, which make high plus reading additions very desirable when applicable.



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in proportion to the amount of light received. When moistened. the unhardened portions become wetter than the hardened portions. When inked, the wetter portions accept less ink.

xerography **X**

a recent and basic electrostatic process with applications in both printing and photography. Its commercial applications have been pioneered and developed by the Xerox Corporation,

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Figure 3.—Comparison of normal size type (10 point) with xerography enlarging process (24 point).

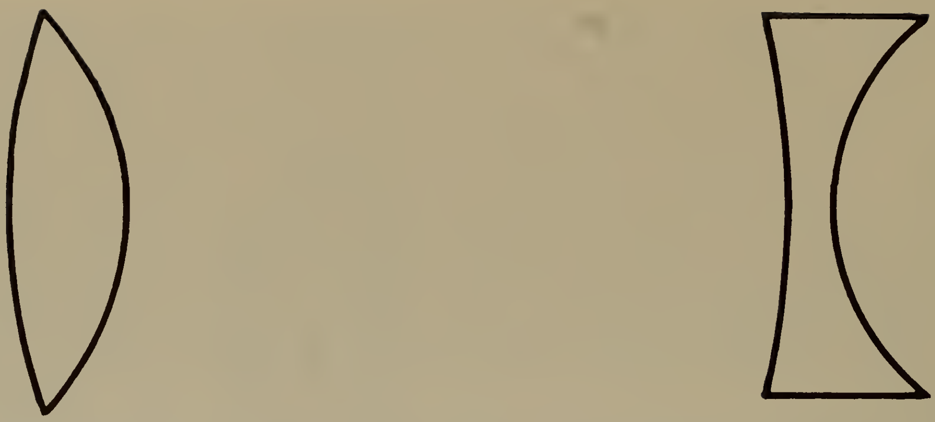

Figure 4.—Diagram of biconvex (high plus) lens and diagram of biconcave (high minus) lens.

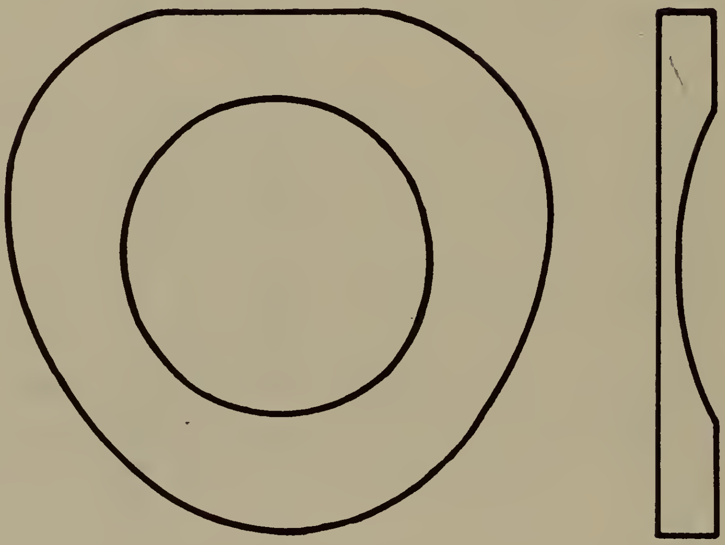

Figure 5.—Diagram of one type of strong concave lens—Myodisc.

There are also certain advantages of prescribing convex lenses primarily in the bifocal or half-eye lens forms. They tend to be less conspicuous, the field of vision is increased (3½ × larger than with telescopic lenses), there is usually simultaneous vision for distance and near, they are usually less expensive. They are usually more comfortable and convenient.

Pinhole Spectacles

Pinhole spectacles are utilized in single or multiple hole type. This is one of the earliest forms of aid for the visually handicapped. However, it is not utilized in great numbers today. This type of aid permits only the axial rays to pass, they restrict rays which may be dispersed by opacities in the media. They also restrict the quantity of light producing dilation of the pupil. The patient may be able to see around a central or macular defect.

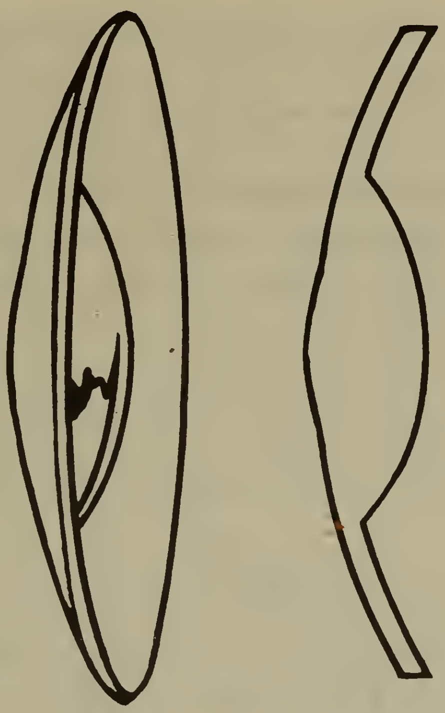

Figure 6.—Diagram of Aolite plastic aspheric lens.

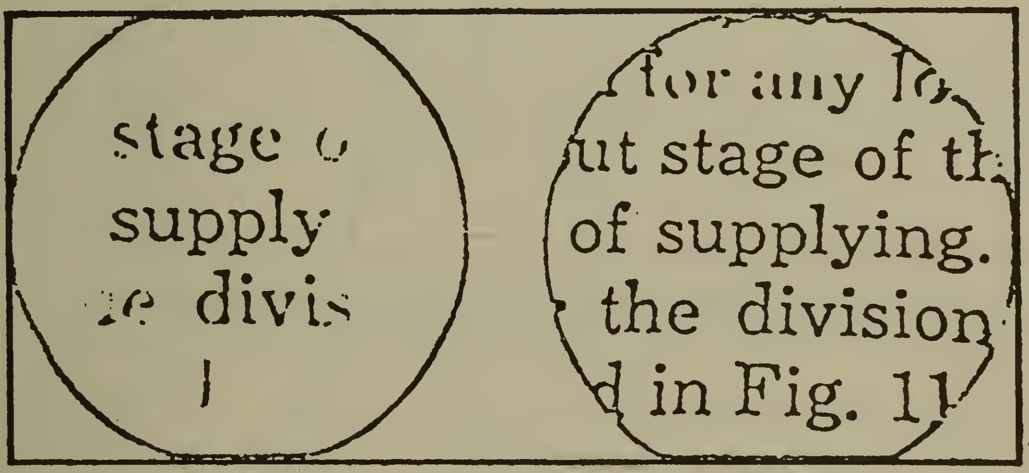

Figure 7.—The relative performance of an aspheric lenticular and conventional lens of the same power.

Telescopic Lenses

Telescopic and microscopic aids are not only more frequently prescribed but are held to represent highly refined attempts at providing the most ideal optical design. Although telescopic lenses are employed primarily for distance vision, a reading cap is usually prescribed in order that the patient may perform near tasks without changing the visual aid.

The development of these aids indicates that professional interest in aiding persons with low vision through the use of telescopic magnifiers can be traced back over 200 years. Despite its long history many of the optical and physical problems involved in telescopic lens design were not solved until the dawn of the 20th century. (See figs. 8 and 9.)

The basic principle of these aids are those of the Galilean telescope—an eye piece with an ocular. (See figs. 10 and 11.)

Ambulation is usually difficult due to the restricted field and the apparent paraletic displacement of the image. These lenses are best used when head movement is at a minimum as for theater or television viewing.

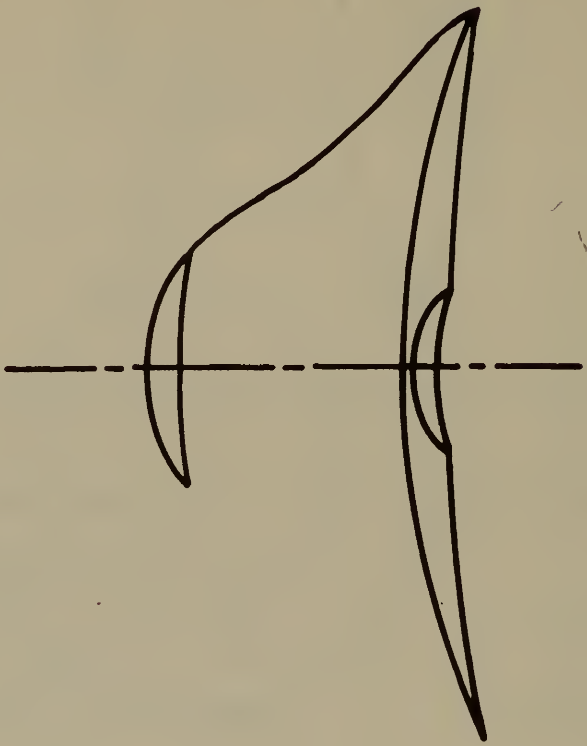

Figure 8.—Muller's telescopic spectacle invented 1912.

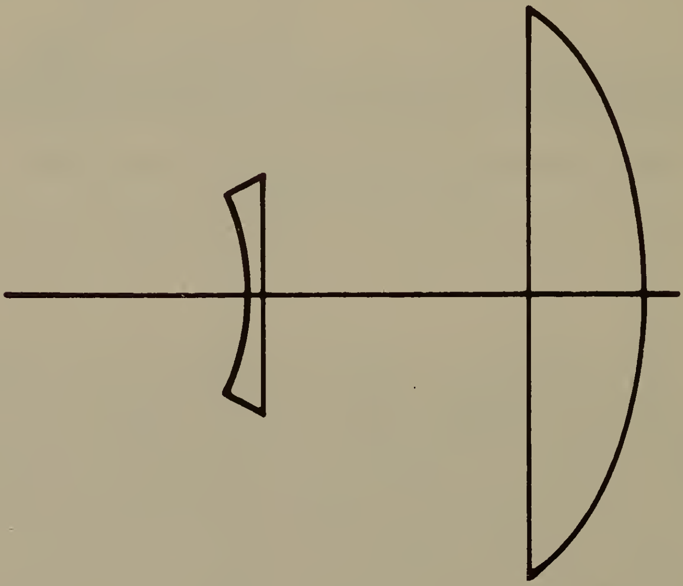

Figure 9.—Diagram of basic telescopic lens principle—convex objective lens with a concave (eye piece) lens separated by air.

A small segment telescope may provide up to 2.5 ×. These are small in diameter with a small field of view. This aid is mounted in ordinary corrective lenses in order that the patient may either look through the scope or the ophthalmic lens at will.

There are numerous specifically designed telescopic lenses—such as:

1. The 10 × prism monocular—this aid may fill a certain need for a few patients, even though it is difficult to use because of the high magnification and the very small field of view.
2. The Kollmorgan and Stoepsel (see fig. 10) type—no longer available, however, patients still may be wearing this aid.
3. Dixon mirror (see fig. 11). This aid utilizes the reflectance of light into concave and convex mirrors in order to enlarge the image.
4. Feinbloom—Microscopic magnification (see fig. 12) also utilizes mirrors rather than lenses. The field is quite small but the magnified field is in the center of an unmagnified periphery so perspective is not lost. Magnification is 3 ×.
5. Behr-Fleming aids are all plastic with aspheric corrective lenses available in 1.8 × and 2.0 ×. They are usually lighter in weight than most of the other telescopic aids.
6. Univis (see fig. 13)—these aids are available in 1.5 × and 2.0 ×. They allow a small field of view with an undistorted periphery. This aid is mounted in a hole drilled through the regular ophthalmic lens carrier. They are all glass with an additional power available to be clipped over for utilization for near vision.
7. Sport Oculars are ready made and commercially available. They are usually mounted in some type of spectacle form.
8. Clip-on Monocular Telescopic Spectacles—these may be utilized as hand held or as clip-ons to a frame.

The Behr Loop is another type of low-vision aid. This device consists of a —12.00 SPH or —12.00 segment cemented in the upper-outer portion of the carrier lens (a +3.00 sphere) utilized at a distance of 10″.

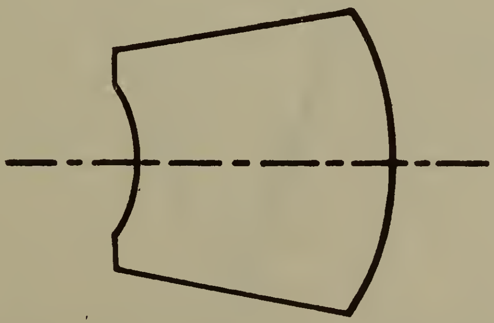

Figure 10.—An all glass telescopic lens system with convex front surface and concave back surface (Stoepsel lens).

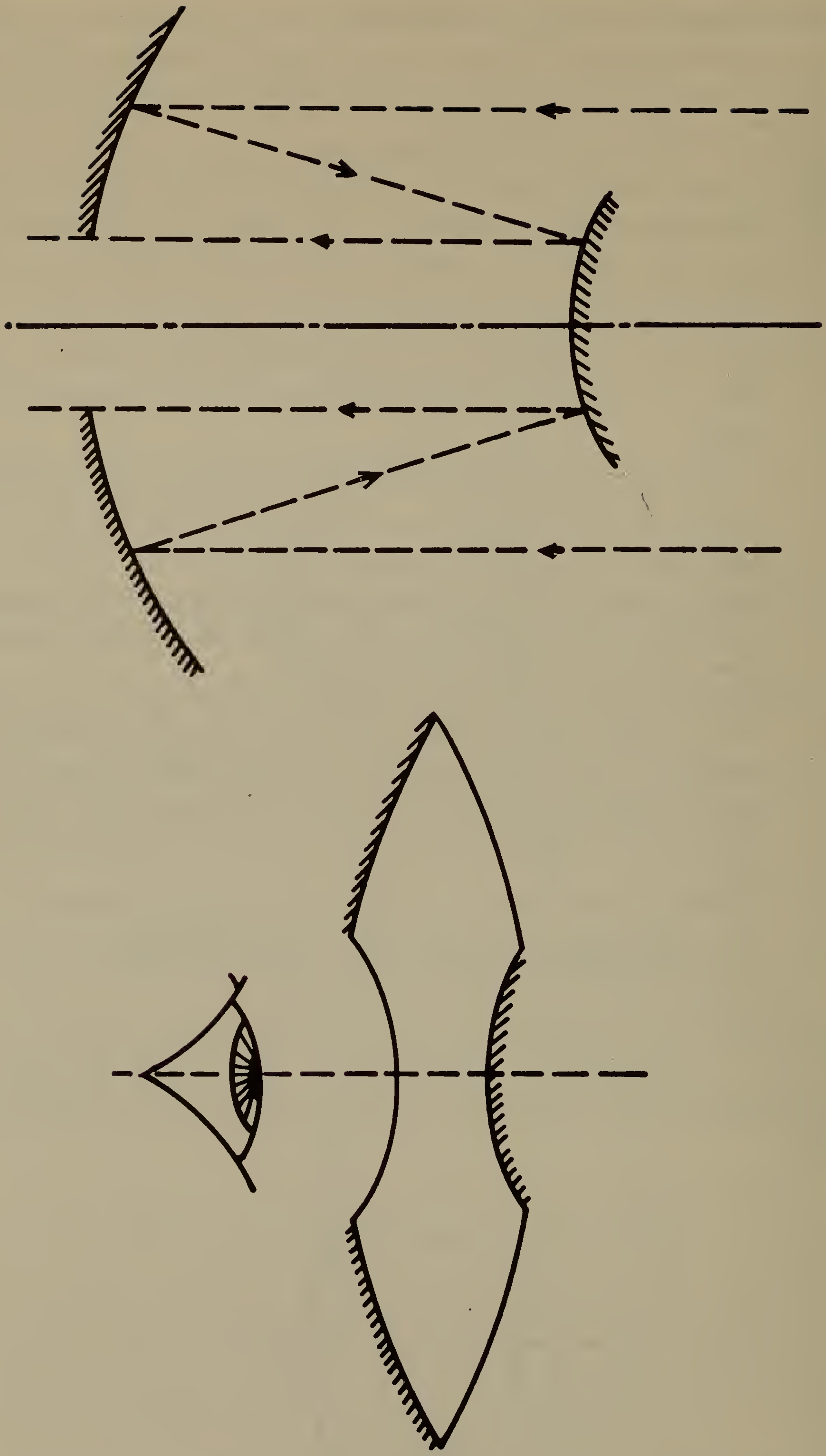

FIGURE 11.—Diagram of a mirror type telescopic system—Dixon or Cassegrain.

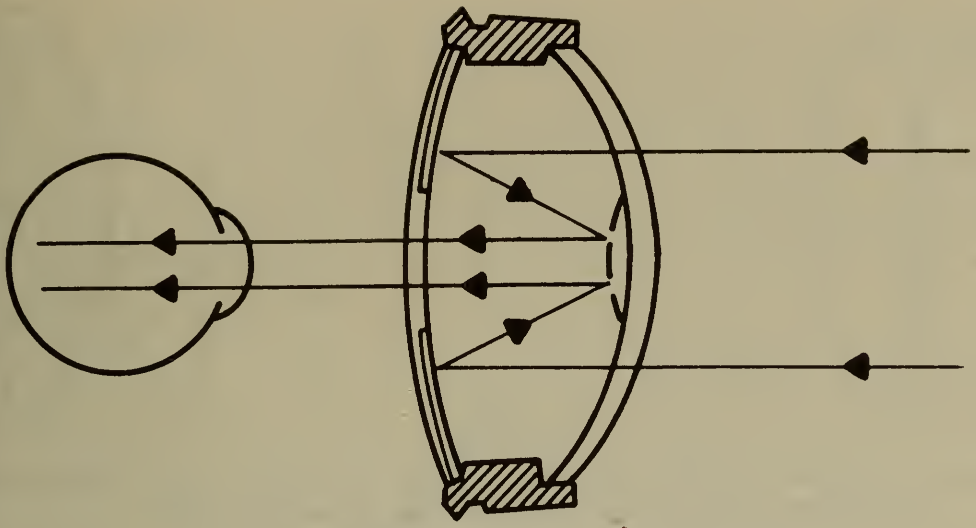

Figure 12.—Feinbloom's mirror telescopic system.

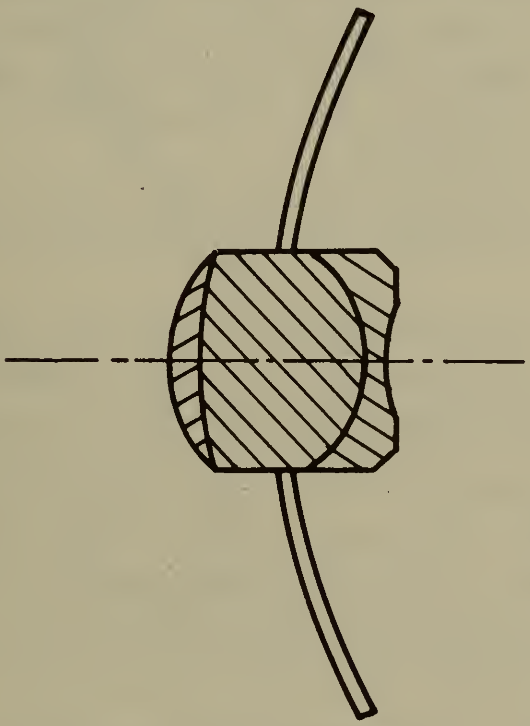

Figure 13.—The Univis afocal magnifying unit used for distance vision. Unit is mounted in a carrier lens.

Microscopic Lenses

Single lens reading addition combined with the telescopic spectacle usually affords proficient magnification for reading fine print for many patients. However, some require more than magnification afforded by the telescopic spectacle and reading cap. To achieve the required magnification for these patients a compound microscopic lens is utilized.

The optical design of a microscopic lens permits a flat corrected field of view that often results in more satisfactory use by the patient than other aids. These lenses consist of two or more lenses (doublet-triplet) with an air space or cemented together. (See fig. 14.)

Microscopic aids are adaptable for near vision only, however, they

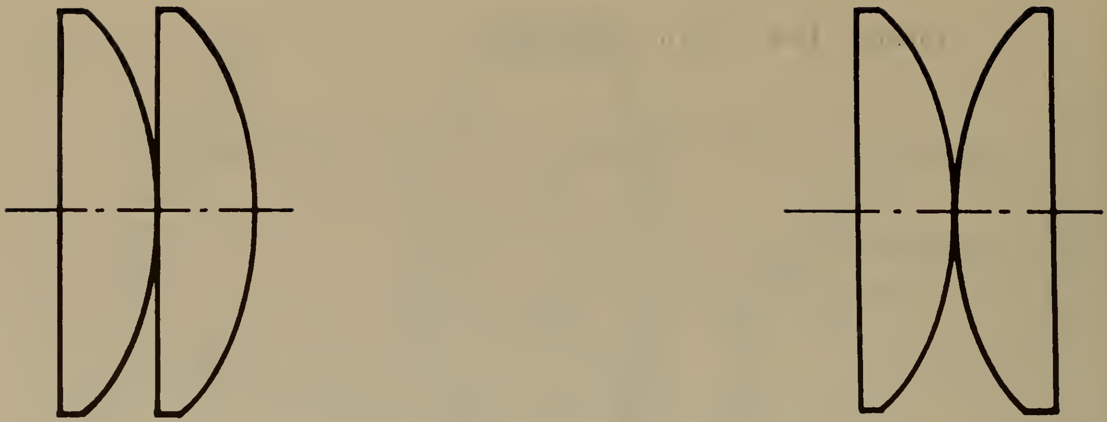

FIGURE 14.—Diagrams of two types of doublet air space lenses. Figure on the right has an optical performance superior to that shown on the left.

can provide up to 20 × magnification with a satisfactory working distance. There are numerous types of microscopes available. These include:

1. The Clear Image (Feinbloom). These are glass convex lenses mounted in a plexiglass rim. They are available from 2.0 × to 20.0 × in 2 × intervals.
2. Behr-Fleming Microscopes—a plastic aspheric lens mounted in a clear plastic rim available with magnification of 10.5 ×, 11.5 × and 15.0 ×.
3. AO Microscope (no longer manufactured). These are all glass-ground with a flat carrier lens edged and shaped to fit a regular spectacle frame in 2 ×, 4 ×, 6 ×, 8 ×.
4. Volk-Conoid—a single spherical convex glass lens available with magnifications up to 25 ×. These lenses are specified as +15., +25., +30., +35., +40., +50., +60., +80., and +100. (magnification = D/4; e.i. +40/4 = 10).
5. Policoff bifocal inserts are set in single vision lenses which carry a distance R × if required, available in 3 ×, 5 ×, 7 ×, 10 ×, 14 ×.
6. Aolite aspheric magnifields are all plastic lenticular in form produced in 8 ×, 10 ×, 12 ×.

Contact Lenses

Within the field of low vision aids, contact lenses have their primary value in helping patients with high degrees of astigmatism such as found in keratoconus, in corneal scarring and in high myopia.

Corneal or scleral lenses would first be thought of as an aid in helping many visual problems of the partially sighted. Many times the patient never able to achieve satisfactory acuity with corrective lenses alone will get almost magical improvement of their vision merely through the use of contact lenses.

There are numerous other areas of use for contact lenses—with permanent mydriasis of the pupil, distorted pupil shape, coloboma of the iris and aniridia. For a large irridectomy and with multiple opacities of the media scattering light, the use of contact lenses with an opaque painted iris and a clear pupil could be efficiently utilized.

The use of contact lenses in conjunction with and without a spectacle lens (see fig. 15) to produce magnification comparable to a telescopic system has been used quite extensively; however, the combination was found to be very limiting.

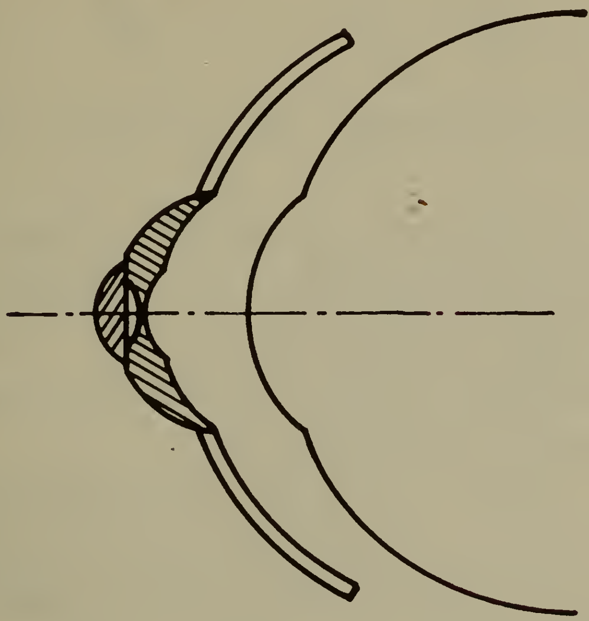

FIGURE 15.—A schematic view of the Feinbloom contact lens telescopic unit (not too successfully utilized).

Vistacon System—utilizes the reverse Galilean principle. This is a high plus contact lens with minus spectacle power. It is difficult to fit to patients with a severely reduced central visual acuity. The weight and thickness of the contact lens also creates fitting problems. The patient's field tends to be distorted. His speed and movements are also reduced. The patient will also feel far removed from objects and must readapt to new spacial relationships. This is a highly specialized telescopic situation not often used.

Telecon System (see fig. 16)—utilizes the Galilean telescope principle. A contact lens in bifocal form is fitted with an average of—50.00D over correction—the peripheral field of the lens is the best possible spectacle correction.

A cemented bifocal of 10mm. diameter is placed on the back of the spectacle carrier to form the complete telescope.

With this system it is very difficult to obtain great amounts of magnification (maximum 2.0 ×).

While the central field of vision is clear and magnified, the vision drops off very sharply as the patient moves his eyes toward the periphery of the ophthalmic carrier.

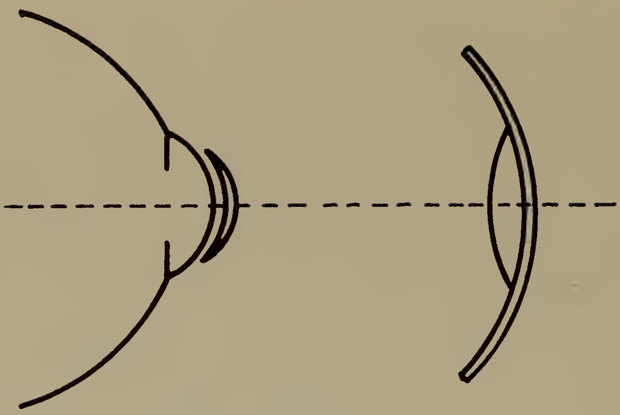

Figure 16.—The Telecon contact lens telescopic system.

Patients will often reject this type of composite also, because of the apparent distortion in the periphery. From a cosmetic standpoint they would be rejected due to the weight of the carrier lens as well as the adaptations required to wear contact lenses.

Another disadvantage is that all lenses must be centered perfectly as this is very critical to maximum efficiency.

The increase in visual acuity secured by numerous practitioners in fitting low-vision aids is well documented. In one evaluation a comparison was made between patients employing the use of telescopic aids versus hand-magnifiers. (See figs. 17 and 18.) It should be noted in this study that the distance visual acuity of approximately two-thirds of all the patients involved had increased to 20/60 or better. The number of those having acuity of that value for near would be expected to be appreciably higher.

Just recently I learned of a research project currently being conducted regarding motor vehicle operation with low-vision aids. The preliminary report of this optometric project reveals that approximately a little less than 60 percent of all aids utilized for increase in distance visual acuity could conceivably find their way into the driving situation on our highways.

This research is still in its formative stages and the investigators believe it will be impossible to define the parameters of the project for several years.

The formula for achieving success with partially sighted patients is not a secret. First in importance is finding a practitioner who is knowledgeable and can utilize the special procedures and techniques necessary. Second, this specialized practitioner—whether he be a doctor of optometry, medicine, or osteopathy—must have available adequate equipment to evaluate, to train, and to demonstrate. Third, the potential patients must be aware of the visual aids available to them. Many optometric centers and clinics have used this formula successfully for years. It has also been applied in private practices throughout the country.

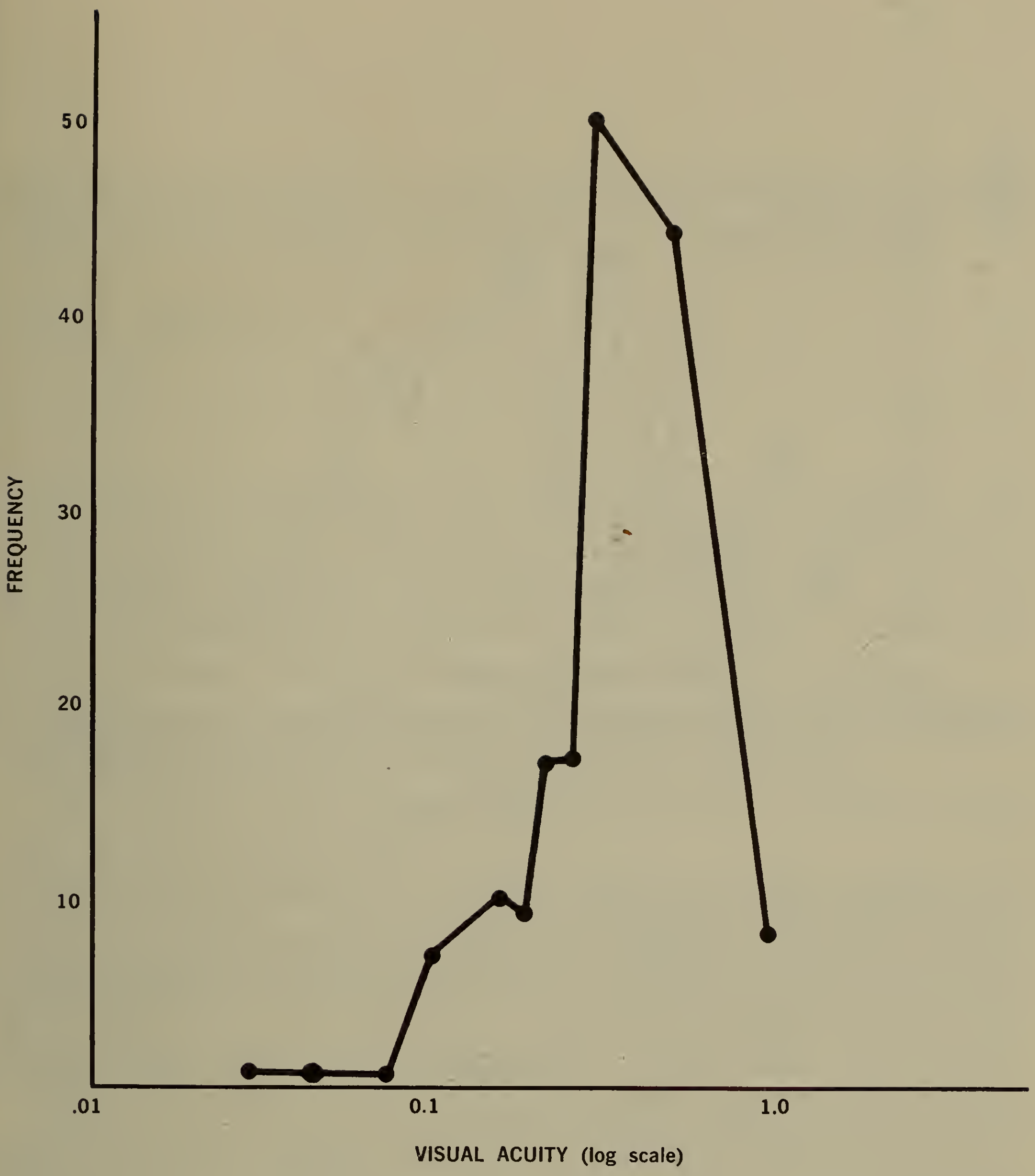

Figure 17.—Graphical illustration of the increase in the distance visual acuity secured by the use of telescopic spectacles. (Ellerbrock.)

Surprisingly, numerous legally blind persons do not know of the expanded and great numbers of special services available to them. And yet there are few, if any, modern doctors of optometry who would consider the use of the eyes with low acuity to be dangerous, detrimental or contraindicated. An abundance of evidence supports the contrary.

So often we find patients in our practice who make microscopic correction and talking book machines or other aids into focal points of their existence. The aids become virtually indispensable, even though they may offer only a small vision improvement. This is understandable, for it is through such aids that patients discard the notion that they are hopelessly handicapped. And through such aids my profession offers a great opportunity.

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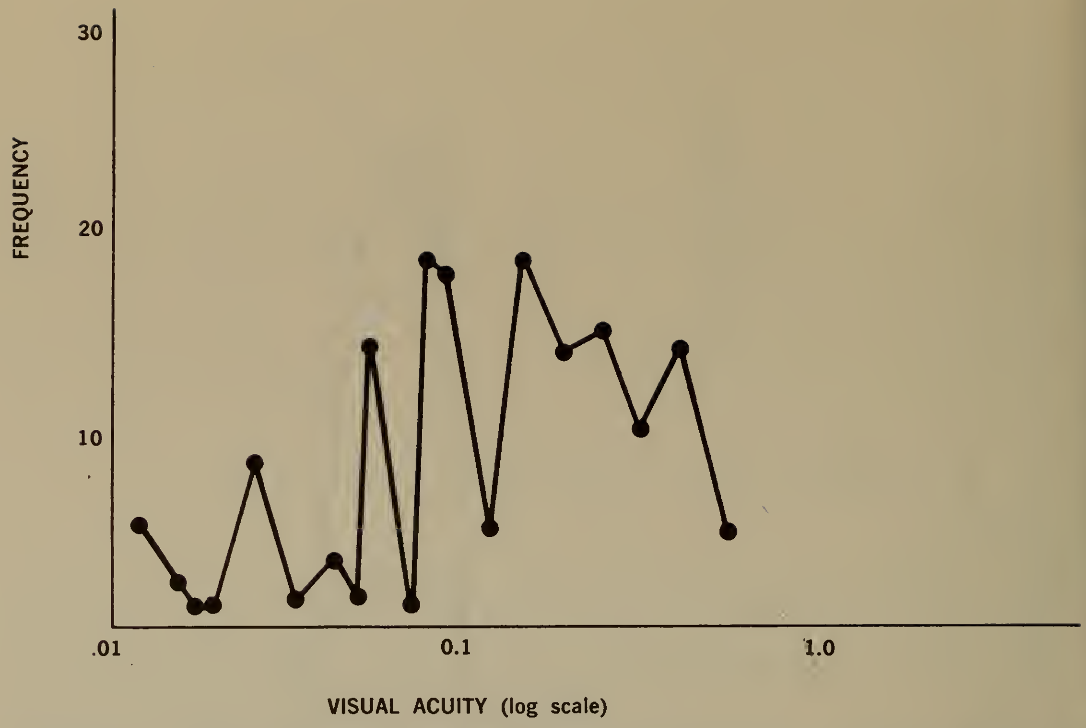

Figure 18.—Graphic illustration of the increase in the distance visual acuity before the use of telescopic lenses. (Raefler-Frommannsche Buchdruckerei, Ellerbrock.)

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AWARENESS, ATTITUDES AND PERFORMANCE IN REPORTING BLIND PERSONS TO REGISTERS

ALMA D. THOMPSON[1]

THE AMERICAN FOUNDATION FOR THE BLIND, INC., made this study under a contract[2] from the National Institute of Neurological Diseases and Blindness (NINDB). The latter's name was changed to National Institute of Neurological Diseases and Stroke (NINDS) in 1968 when the law creating the National Eye Institute (NEI) was enacted.

The American Academy of Ophthalomolgy and Otolaryngology and the American Optometric Association endorsed the study.

The American Medical Association reviewed and cleared the four types of questionnaires used.

The study tried to find out why ophthalmic and optometric eye examiners were not reporting their blind patients to registers.

Nonreporting is important because it reduces a register's usefulness for research, statistics preparation, and for providing rehabilitative, financial, or medical services to the blind.

The Psychological Corp. interviewed the persons included in the study during June and July of 1965. It did not interview general practitioners (M.D.'s), nurses, or social agency personnel even though they refer blind persons to State blindness agencies for services. It interviewed ophthalmologists (including eye-ear-nose-and-throat specialists), optometrists, State blindness agency directors, and their consulting ophthalmologists. This paper identifies these hereafter as ophthalmologists, optometrists, directors, and consultants, respectively.

A State register of the blind is mandatory if a law requires its establishment and continual maintenance. However, the reporting of blind persons to such a register is not necessarily mandatory. A State was included in this study if it had a mandatory register as of May 1965 even if the reporting to its register was not mandatory.

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[1] Statistical Assistant, Section on Blindness Statistics, National Eye Institute, National Institutes of Health.

[2] PH–43–64–531, Feb. 14, 1964 to Dec. 13, 1966.

Only 14 of the 29 States in this study were in the Model Reporting Area (MRA) for Blindness at that time.[3]

These 29 States had 8,364 eye examiners in 1965, comprised of 3,074 ophthalomolgists and 5,290 optometrists. It was planned to interview 879 ophthalmologists, 373 optometrists, and each of the 29 directors, and consultants.

Forty percent of the 879 ophthalmologists and 37 percent of the 373 optometrists refused to be interviewed or were not available.

Consequently, this study interviewed 819 persons comprised of: 527 ophthalmologists, 234 optometrists, 29 directors, and 29 consultants.

The objectives and legal basis of registering the blind were covered in the directors' and consultants' questionnaires.

The legal definition of blindness, awareness that blindness registers exist, knowledge of their purposes and usefulness, and knowledge of procedures for reporting blind persons to such registers were probed in the ophthalmologists' and optometrists' questionnaires.

Blindness is defined in various ways, but usually as the inability to do ordinary activities requiring eyesight. Therefore, blindness is more inclusive than total blindness, the complete loss of all sight capability (no light perception). A legally blind person is one who has lost a stipulated percent of central visual acuity or visual field. The MRA defines a person as blind if the better eye with best correction has a distance visual acuity of 20/200 or less; or if its visual field is restricted to 20°. This is the most widely used definition of blindness for legal purposes. However, no Federal law or regulation forces States to use a common definition. Therefore, they defined blindness differently and even within a State it was defined differently for welfare, tax exemptions, education, and industry.

Only 9 percent of ophthalmologists and 3 percent of optometrists knew exactly their State's legal definition of blindness. Some mistook the general definitions of blindness for the legal one, while others mistook visual impairment, a larger category which included blindness as a subgroup, for the legal definition.

Ophthalmologists and optometrists generally disliked the current definitions of blindness and suggested that they be changed. Some recommended a single definition for use everywhere in the Nation, while others objected to any one definition. Since a legally blind person has lost a specified percent of visual acuity or visual field, some believed that these factors should be measured in a standardly prescribed way. Both the ophthalmologists and optometrists suggested uniform eye testing charts, light, and testing objects. Ophthalmologists wanted the definition to include sensitivity to light, color sense, condition of ocular muscles, employment type, and remaining functional vision. They wanted to consider the whole person relative to visual impairment, remaining functional vision, and educational and employment potential. They wanted to evaluate the individual and the visual problem together preferring sound clinical judgment, rather than adhering to an arbitrary rule. Ophthalmologists unanimously wanted the word "blind" deleted from definitions of visual impairment and from titles of agencies serving the visually impaired. They said the word was too final and the patient's reaction to it unfavorable.

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[3] States in the MRA: Connecticut, Kansas, Louisiana, Massachusetts, New Hampshire, New Jersey, New Mexico, North Carolina, Oregon, Rhode Island, South Dakota, Utah, Vermont, and Virginia; States not in the MRA: Arizona, Delaware, Florida, Indiana, Iowa, Hawaii, Minnesota, Missouri, Nebraska, New York, Ohio, Pennsylvania, South Carolina, Texas, and Wisconsin.

Nearly three-fourths of ophthalmologists and more than half the optometrists said they were aware of the register. Some believed mistakenly that certification to the U.S. Internal Revenue Service for tax exemptions registered that person. Many thought that they had registered their blind patients when they reported them to agencies for welfare or pension purposes. Some thought that they had registered a person if they had contacted the State agency by telephone or letter.

The ophthalmic and optometric disciplines referred their blind patients most frequently to workshops which they praised for training or retraining blind persons, and job placement services. They also praised fraternal organizations which sponsor recreational activities for the blind.

Most eye examiners became aware of the register after completing their professional training. They usually heard about it from directors who contacted them about reporting or sent them literature describing the services provided to the blind. Some eye examiners worked in clinics or schools or donated time and services to organizations which aid the blind and heard of the register through this association.

Some eye examiners believed that the registers are useful for medical research. Others believed that they help Federal, State, county, and city governments and private groups to plan programs and allocate funds.

Many eye examiners did not register their blind patients because they thought it was not compulsory. Most eye examiners considered the register a direct link to public assistance and for welfare recipients only. Ophthalmologists did not register patients who did not need help. They rarely reported a patient if financial assistance was not required, and did not report the temporarily blind if they could be treated by refraction, medication, or surgery. Ophthalmologists working in eye clinics normally see more blind patients than those practicing alone. Yet, very few clinic ophthalmologists reported their patients. Some assumed that their blind patients were registered while others said that clerical personnel should register them. Ophthalmologists reported their blind patients to registers, or did not report them depending on their age, employability, and physical condition. Blind persons often were not reported if they were too young, too old or too ill to be rehabilitated vocationally.

Some blind persons did not want to be registered. The examiners commented that the newly blind were particularly sensitive and believed that registration and the services offered were only for the indigent. They refused to be registered because they associated the register and services with charity. Many blind persons feared employment loss if their employers heard of their blindness. Some blind persons operated as sighted individuals. They worked, drove cars, and had active social lives. Many refused to be registered because they expected society to restrict their activities if their blindness became known.

Some blind persons did not know that they were blind because their eyes had not been examined. The eye examiners who were unaware of registers and requirements for reporting their blind patients did not always report them. Some forgot to report, some neglected to report, some did not report because it wasn't compulsory, and some did not report because the blind did not want to be registered for various reasons of their own. Some ophthalmologists did not ask their patients if they wanted to be reported, particularly if they did not appear to need help or want it.

The patients whom directors referred to eye examiners generally knew about available benefits and wanted to be registered. However, since ophthalmologists often did not discuss the register and reporting with their private patients, the attitude of these private patients toward registration was unknown. Some patients preferred not to be registered and did not know that services were available from blindness agencies. Obviously, they might want to be registered if they knew that they could get services.

Applications for tax exemptions, pensions, admissions to schools for the blind, and welfare payments were mistaken by eye examiners for the form for reporting eye examination findings to the register. Examiners familiar with the form for reporting objected to its excessive length and the time required to prepare it. They preferred a brief form on a postage prepaid card. Most examiners had to request reporting forms from directors and complained of not having them when needed. They preferred receiving forms periodically.

Eye examiners wanted more information from directors about the purposes of registers and their advantages to blind persons. Before the interview, many eye examiners did not know there was a register. They agreed that registration helped research on visual system diseases and preparation of statistics on blind population. However, they believed that blind persons derived no immediate value from being registered.

Eye examiners wanted more and better communication from directors. They wanted detailed information on services available to the blind. Some wanted directories with locations listed and facilities and services described for easy reference. Others suggested personal visits from representatives of the directors.

Optometrists preferred mandatory reporting. Ophthalmologists preferred voluntary reporting for two reasons. First, they believed that registration without the patient's consent was an invasion of his privacy. Second, they opposed anything compulsory and Government regulated. Optometrists believed that more blind would be reached and helped if reporting were mandatory. No eye examiner wanted to be penalized for not reporting even when reporting was mandatory.

Both the ophthalmic and optometric disciplines wanted to protect the community from visually defective motorists.

The consultants reviewed eye examination reports for various purposes. They decided whether a patient was legally blind, recommended medical services, surgery, visual aids, determined the patient's eligibility for pensions, compensation, tax exemptions, welfare, and various services. A few helped the director's staff to code blinding affections and their etiologies.

A few consultants did not know the purpose of the register. The others regarded it as reliable for estimating the blind population and for reaching blind persons needing medical care, education, rehabilitation, and other services. The directors considered the register very important and said that it would be difficult to function without it. However, they believed that the register was less valuable for research than for making services available to the blind. The directors thought it was invaluable for program and budget planning. Both consultants and directors realized that some persons were not reported to registers particularly the elderly, the children, the financially independent, the unexamined, the blind who did not know that services were available to them, the ethnic groups which did not reach beyond their cultural circle or allow help to enter, those who refused registration to avoid blindness and welfare stigmas, or because they did not need help, and those whom the eye examiners did not report to registers.

The consultants and directors believed mandatory reporting would increase registration and thereby reduce the unreported blind population. However, they felt that mandatory reporting could not be enforced. They resented Government interference, and wanted the privileged communications between patient and physician to be preserved. They thought it was unnecessary to register all blind persons, particularly if they did not need services or did not want them. They thought that the cost of registering persons not presently reported would exceed the benefits that could be expected from registering them. They believe that the register is more useful for providing services to blind patients than for statistics preparation.

The consultants and directors thought that it was not important for blind persons to be reported if they did not require assistance, but they encouraged reporting of the needy blind so they could be assisted. They agreed that eye examiners and directors should cooperate more and communicate better with each other.

In some States the blind were reported to registers on forms which were not eye examination forms. Ideally, the reporting form should be an eye examination form that has the visual acuity and field measurements, history, diagnosis, prognosis, and recommended treatment. Unfortunately, they were not standardized and though many are good forms, some were much less than ideal. However, the consultants and directors generally were satisfied with the ones they used.

Most directors sent eye examination reporting forms to eye examiners only upon their request. Patients reached the register agency from ophthalmologists, optometrists, clinics, general practitioners, schools, churches, home teachers, social service workers, friends, relatives, etc. Regardless of how the patient was referred to the agency a form was sent to the original examiner for completion.

The directors generally were satisfied with eye examination reports from ophthalmologists. They found 75 percent of them to be complete and returned the incomplete ones for additional information if needed.

Most directors accepted reports from optometrists on refractive anomalies and commented on their splendid cooperation. Half of the directors sent the same form to optometrists and ophthalmologists. The others used separate forms. When a single form was used by both ophthalmologists and optometrists there was a space for indicating the examiner's discipline. Soon after a person was registered, the director told that person what services are available by telephone, letter, visit from a social worker, pamphlet, or brochures. Four directors did not inform registered persons of available services if their eye examiners had requested that the agency should not contact them.

The directors were less critical of the legal blindness definition than the eye examiners were. This definition, though commonly used and considered the Federal definition, is one of several that might be used in a State. The directors believed that these various definitions serve different purposes and each is needed.

To insure the accuracy of register data there should be systematic register clearance. The directors tried to update the essential items on the register card. Since most registered persons received health, education, or welfare services, the contact with financial or other service offices was a cross-check. Braille students and the blind receiving home services were visited regularly and this personal contact by staff members determined continued eligibility. Patients were reinterviewed, reexamined, and new eye examination reports were submitted in the course of treatment. The patient who left a State asked to be referred to the new State agency or the new agency contacted the old for information. Staff members checked obituaries. The patient who was not contacted was visited or sent a register census card at least once a year. Except for the States that used census cards the States cleared their registers continually, not once in a specified time interval such as a year. Twenty-five States removed a person from their registers after sight restoration. One State kept a person on the register from 5 years to death, depending on the program the patient is in. Another placed the person in a separate file, and removed the person from it after 7 years if no service was required. Two kept the patient on the register, with a notation that vision had been restored.

Most directors participated with Federal or State agencies and educational institutions in research which nearly always was financed partially by State or Federal grants. Only two directors received research grants from private organizations.

Two of the directors communicated with eye examiners in various ways, including letters, pamphlets, brochures, speeches, TV and radio spot announcements, and newspaper articles. Consequently, their consultants, eye examiners, other referral sources, and the visually handicapped population were aware of the register's existence and of services available to the blind.

Some directors communicated very little with eye examiners. Most sent letters, pamphlets or brochures to eye examiners and to civic and professional groups. Some sent statistics from their register or copies of MRA reports. The director or staff members spoke at conferences of medical and private groups, which responded with statements of appreciation, or better yet, reported more blind persons for registration.

The directors and consultants agreed that communication was necessary to increase registration. Most directors used whichever media they could afford that gave tangible results. The major deterrent to communication was the lack of funds. The directors hoped for increased budgets with funds earmarked for publicity.

The directors estimated that 50 to 90 percent of registered persons received services from blindness agencies. The eye examiners, on the other hand, believed that almost all registered persons receive financial, medical, education, rehabilitation, home, or other services.

Most of the interviewed persons agreed that blindness registration should be promoted, that it is valuable to medical and statistical research, and for locating blind persons needing medical care, rehabilitation, education and other assistance.

This study has demonstrated that all blind and visually handicapped persons will be registered only when eye examiners, the blind themselves and all agencies that serve them know and understand their register concept.

EYE PROBLEMS OF THE AGED

ABRAHAM L. KORNZWEIG, M.D.[1]

IT HAS BEEN postulated that under ideal circumstances the eye may function up to and past the 100 year milestone (*1*). Visual acuity in some people over age 90 has been reported as equal to 20/20, well within normal range. Postmortem examinations of many eyes have shown normal histological findings in more than 50 percent, according to the histological techniques available today (*2*). Nevertheless, the eye is heir to many disabilities in the aged person. Those which are responsible for loss of visual acuity and their management will be discussed.

Vision

There is an often repeated statement that old age must necessarily bring about a loss of vision. However, it has been shown that only 15 to 18 percent of the aged population has poor vision (*3, 4*). The remaining 82 to 85 percent has good to adequate visual acuity to age 90 and even beyond. Good vision is considered to be 20/20 to 20/30; fair to adequate vision 20/40 to 20/70; poor vision is 20/100 or less. Frequently, though one eye is poor, the other eye may have good enough vision to enable the person to function well. Many aged persons have limited activities, so that fair to adequate vision meets their needs.

Since this meeting is primarily interested in the aged blind or near blind, I am limiting my discussion to the 15 to 17 percent whose vision is 15/100 to no light perception. The statistical studies mentioned above involved in one series 1,068 and in the other 800 aged persons. But if these studies are at all representative of the situation in the general population, it represents a sizable number of old people in the United States where the population over age 65 is now close to 20 million people. This would indicate that approximately 3 million aged persons have poor sight to no sight at all.

These figures could be broken down still further. About 1.2 percent are totally blind, 6.7 percent have very poor vision and 6.0 percent have poor vision. But the number of people in these series is too small to be statistically valid for a population study. It does, however, indicate a probability.

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Cataract

The most common disability in the aged eye is the formation of cataract, or lens opacity. Studies indicate that if a person lives long enough, he will eventually develop cataracts (*5*). In one study of more than 1,000 residents of a home and hospital for the aged, over 60 percent showed evidence of cataract formation (*3*).

The underlying metabolic disturbances that contribute to the formation of cataract are not fully understood. The lens is a small disk of transparent tissue contained within a hyaline capsule, much like a cellophane wrapper. New fibers are formed inside the capsule throughout life, though at a diminishing rate, each fiber superimposed upon the preceding one. The lens is nourished by the aqueous fluid which circulates in the anterior segment of the eye. Its elasticity also decreases progressively as it grows older. The metabolism of the lens is of a low order since it has no blood or lymph vessels. All needs for oxygen, sugar, salts, and minerals are supplied by the aqueous fluid.

In its optimal state, the lens is perfectly clear and transparent, transmitting and refracting the rays of light to the retina. But as the eye ages, the lens fibers which are constantly being compressed toward the center, lose their transparency and assume a yellowish or yellow-brown color. This is called nuclear sclerosis and indicates the beginning of a senile type of cataract.

Another form of cataract formation is opaque spokes, groups of lens fibers that have lost their transparency. Others fibers may undergo liquefaction and cause water fissures in the lens. Another site for cataract formation is the posterior subcapsular area. Recent studies indicate that the prolonged use of corticosteroids either topically or systemically may give rise to such posterior subcapsular opacities (*6*). These opacities may occur in aged individuals who have never had steroids. Until more is known about the underlying pathological processes, little, if anything, can be done to prevent or retard cataract formation. The only successful treatment is the removal of the cataractous lens. This, in skilled hands, is 95 to 98 percent successful.

Much has been done in the last few years to improve surgical technique for cataract extraction. Fine silk or chromic catgut sutures are now used to close the incision. This allows the wound to heal firmly with less postoperative bleeding into the anterior chamber. It also permits early ambulation of the aged patient, who may be out of bed on the first- or second-postoperative day. This minimizes pulmonary and vascular complications. A new digestive fluid enzyme, alphachymotrypsin (1/10,000 solution), may be injected into the anterior chamber underneath the iris pillars at the time of surgery. The enzyme has a specific effect on the zonular fibers which support the lens; they appear to dissolve in about 3 minutes. The lens now rests upon the surface of the vitreous body. It can then be removed, with minimum traction or pressure, using a capsule forceps or a suction cup called an erisophake. The lens is thus usually removed within its capsule. Better postoperative healing and better visual acuity results, since no lens matter or capsule is left to interfere with vision or give rise to postoperative reactions.

Of late a freezing technique (cryoextraction) enables the surgeon to freeze the lens to an instrument, a cryoextractor, and remove it from the eye. This method has reduced the complication of ruptured lens capsule to a minimum.

Local anesthesia is usually sufficient for cataract extraction. In the unusual hypersensitive or nervous aged individual, general anesthesia may give complete control over the relaxed patient. Improvement in general anesthesia has progressed to the point where cataract removal is possible with safety and with a minimum of post-anesthesia reactions. This is not only a boon to the apprehensive patient but also to the surgeon, who otherwise has to watch every movement of the patient while performing the extraction.

Not all patients with cataract formation require surgery. Frequently, one eye is less advanced than its fellow and its vision is adequate for all needs. Operation should not be withheld, however, because of age or associated physical infirmities. Several studies have shown that aged persons withstand cataract surgery very well and have a good expectancy of recovering functional vision (*7*). Generally, if the patient is ambulatory, is well-oriented, needs the operation and desires it, it should be done. Those patients who fear the operation unduly should be told of the limited hazards and the high percentage of good results, with modern methods of treatment.

At one time cataract extraction was delayed until the lens was "ripe" or "mature". Such is not the case today. With newer techniques, it is possible to remove the lens as soon as the patient is handicapped in his ability to read, write, sew, or do any of the desired visual activities. A patient who has a cataract in one eye only can still have it removed and obtain binocular vision if he can be taught to wear a contact lens on the operated eye.

Glaucoma

The management of glaucoma is the next most important eye problem. There is an increase in glaucoma from age 40 to about 65, following which the percentage levels off. In the study mentioned previously (*3*), the level was about 5 percent in the group of 1,000 persons over age 65. There was also a group of possible or potential glaucoma cases that numbered about 7 percent. Eventually, a certain number of these patients developed glaucoma, so that the total number of glaucoma cases was closer to 9 percent (*8*). This is higher than in some other studies of the general population. In one study of 10,000 individuals aged 40 and up, glaucoma cases ranged from 1 to 2 percent (*9*).

Much depends upon the criteria used to define glaucoma. About 10 years ago, the upper limit of normal intraocular tension by Schiotz tonometry was considered to be 25 mm. of Hg. Possible or potential glaucoma was defined as being in the range from 25 to 30 mm. of Hg. A pressure of over 30 mm. of Hg. was considered to be definite glaucoma. These criteria excluded too many potential cases of glaucoma, and so the upper limit of normal was lowered to 20 mm. of Hg. and potential glaucoma from 20 to 25 mm. of Hg. Some cases have been encountered which do not conform to arbitrary criteria. Some patients with low pressure readings have signs of optic nerve atrophy and an impairment of aqueous outflow, that are definitely low tension glaucomas. Others with relatively higher intraocular tensions, up to 30 mm. of Hg., have no loss of vision, no field defect, and no obstruction of aqueous outflow. They may be considered normal. In this as in other phenomena, a wide range of variability exists, and the ultimate decision may require prolonged observation in questionable cases.

The recent classification of glaucoma into wide angle and narrow angle is a great step forward in the management. The method of determination is called gonioscopy and consists of placing a special prism contact lens on the anesthetized eye and examining the angle of the anterior chamber with direct illumination and a binocular microscope. Most cases of chronic glaucoma, usually asymptomatic, are of the wide-angle type. Borderline cases exist, and again the experience and judgment of the ophthalmologist are the deciding factor.

Formerly, when acute congestive or narrow angle glaucoma did not respond to therapy for reduction in pressure within 24 hours, surgery was considered necessary to save the eyesight. Several new measures for reducing tension are now available and patients need not be operated upon in such unfavorable circumstances as high intraocular pressure and marked vascular congestion. The first is the use of carbonic anhydrase inhibitors such as acetazolamide (Diamox) administered orally or intravenously. This drug reduces the formation of aqueous solution. A second method is the use of urea or mannitol intravenously, or glycerin in orange flavored water (75 cc. of each) by mouth. These drugs increase the osmotic tension in the circulating blood and draw fluid from the hypertensive eye, and thus lower its pressure. These measures, plus the use of local miotic drops such as pilocarpine hydrochloride (2 percent) every half hour and eserine salicylate (0.5 percent) every hour for 6 hours, improve aqueous drainage through the trabeculae in the angle of the anterior chamber. The combined measures lower intraocular tension and relieve the acute situation.

After the acute attack and the associated vascular congestion subside, these patients should undergo surgery to prevent further episodes and possibly cure the condition. A peripheral iridectomy or a complete iridectomy enables the aqueous humor to go readily from the posterior chamber to the anterior chamber. It will convert a narrow angle to a normal angle and thus prevent future blocking of the angle by a dilated pupil or a ballooning iris.

A growing number of ophthalmologists believe that patients showing the prodromata of acute congestive glaucoma such as blurred vision in one eye, which may last for minutes to hours and is often accompanied by colored rainbow halos around lights, should be operated upon early to prevent the acute attack. Also, patients who have had surgery for an acute attack in one eye and who have a narrow angle in the other, should have the second eye operated upon to prevent a possible attack. It is not easy to convince patients of this necessity. I must confess inability to convince a single patient to have the second eye operated upon prophylactically.

Perhaps I am not fully convinced of the necessity of the procedure. Every operation, no matter how small, holds some potential danger. Many ophthalmologists feel that the use of miotics to narrow the pupil and widen the angle is sufficient to protect the patient. However, I have seen such eyes develop an acute attack even while under the influence of miotics.

On the other hand, the management of wide-angle glaucoma has undergone considerable change, and the tendency is to delay surgery as long as possible. The use of new drugs to diminish aqueous humor formation is of great value in this regard. Carbonic anhydrase inhibitors such as acetazolamide have been helpful, though patients should be watched for side effects. In recent years, instillation of epinephrine bitartrate (2 percent) has been brought back for use in the wide-open angle. It was used about 20 years ago, before the classification of glaucoma into wide and narrow angle, but fell into disrepute because in the narrow angle type it may precipitate an attack by dilating the pupil. Its use is now limited to the wide angle type and, in conjunction with miotics, has helped to keep the intraocular tension well within the normal range.

Another valuable group of agents in use today are the long-acting miotics. These are the anticholinesterase substances such as S-ecothiophate iodide. In concentrations as low as 0.06 percent, a drop of this drug will maintain miosis in the pupil for 12 to 18 hours. It is effective where the usual miotics are unable to maintain normal tension and prevent a loss of visual field. The once common filtering operations are now postponed as long as possible. They are done only when there is optic nerve involvement or marked interference with the outflow of aqueous humor.

A new method called tonography measures the rate of outflow of aqueous humor from the anterior chamber. This helps the ophthalmolgist determine the right time to operate (*10*). A series of measurements of intraocular tension is taken over a period of 4 minutes and the amount of aqueous fluid expressed from the eye in that interval is estimated. The change or fall in intraocular pressure may be recorded on a revolving drum. A markedly diminished rate of outflow means considerable obstruction in the angle of the anterior chamber, and indicates need for another outflow channel to be established surgically.

The chief problem in glaucoma remains its discovery before the onset of irreversible changes such as optic atrophy and loss of vision and visual field. The acute case presents no problem since the patient seeks help immediately. The chronic case or wide angle type is usually asymptomatic and vision may be lost irretrievably before there is awareness of trouble. A study tried in Chicago utilized the service of the general medical practitioner and internist to take intraocular tensions as part of the general medical examinations. This study proved to be effective in finding unsuspected cases. This idea would have significant value in a nursing home or home for the aged where an ophthalmologist is not readily available and the patient may not be in a condition to be moved. The technique of taking the intraocular tension can be readily acquired by a physician after one or two demonstrations. The most effective method, however, is the periodic eye examination of all individuals over 40 years of age, either in the ophthalmologist's office or in eye centers and clinics established for that purpose.

Macular Degeneration

The third condition, macular degeneration, occurs primarily in older people and leads to loss of central vision, that vision which is clearest and sharpest. Peripheral vision is unaffected so these individuals never become totally disabled, can take care of themselves, and do many types of work not requiring sharp vision. But patients do complain bitterly of not being able to distinguish faces, read a newspaper, thread a needle, or sew. Visual acuity is reduced to 20/50 or 20/70 in moderately severe involvement of the macula, and to 20/100 or less in severe cases. It affects about 30 percent of the aged population over 65 years of age (*3*). This percentage increases gradually with each succeeding decade. It causes most distress among those people who depend greatly upon their vision for their occupation or avocation.

The macular area of the retina is vulnerable and is affected by many diseases such as diabetes mellitus, severe hypertension, nephritis, parasitic disease such as amoebic dysentery and histoplasmosis, and central nervous system conditions such as multiple sclerosis and vascular thrombosis affecting the visual brain centers. The macular area may undergo degeneration of the senile type from unknown causes. An hereditary predisposition has been postulated, though the evidence is meager. Macular degeneration is known to occur in infants, children, adolescents and adults in the fourth or fifth decades, and this condition may be present in families for several generations. Hence, the senile type has been thought to fit into these groups as the latest manifestation in elderly persons. Its occurrence in siblings has also been reported (*11*).

Others suspect the choroidal circulation, which is the main source of nourishment to the macular region. Sclerosis of the choroidal arteries or the choriocapillaries in this area may interfere with this nourishment sufficiently to cause atrophy or death of tissue. Still another group believes that interference with the retinal circulation or disturbance of the retinal capillaries may also be contributing factors in the loss of central vision. Pathological studies of the retina so far have not been too helpful (*12*). The macular area especially around the fovea shows atrophy of the cone cells, migration of the pigment cells from the adjacent pigment epithelium, cyst formation in the layer of association fibers, some with edema and some without edema, all indicating degeneration of tissue and loss of function.

All this is mentioned to indicate that the treatment for macular degeneration is unsatisfactory. Where there is an underlying disease such as diabetes or hypertension, this condition should be treated vigorously in the hope that it will cause an improvement in the macula. Vasodilators such as nicotinic acid and similar preparations have been tried with little success. Small doses of corticosteroids over prolonged periods have been used in some patients with a modicum of improvement or retardation of the degenerative process.

Considerable investigation of the retinal circulation is underway at several centers, especially in diabetic retinopathy and the changes in capillary structure in old age. By means of a new technique which digests away retinal tissue leaving behind the retinal vasculature, it is possible to study the entire retinal vascular system. A new method for study of the retinal circulation in the living is fluorescent angiography. It is now being used to study patients with macular degeneration, among other conditions of the retina. Ten cc. of a 5 percent solution of fluorescein is injected into the median cubital vein. In about 8 seconds it appears in the retinal circulation. The patient had been placed in front of a retinal camera, with a widely dilated pupil and photographs are taken every 0.8 second. A series of pictures are taken over a period of 1 to 2 minutes, and then in 15 and 30 minutes. The camera is fitted with proper filters to bring out the fluorescence in the circulating blood. In some patients with macular disease, there is a seepage from the capillary circulation into surrounding tissue, which causes edema and eventually degeneration. Using these photographs for localization, these areas of seepage are treated with a minute laser beam which causes coagulation of these areas and eventual sealing off of these leaking spots. In some cases it has helped bring about marked improvement in central vision. While the procedure is still experimental, it holds the promise of help in some of those cases of macular degeneration which up to now were not amenable to treatment.

The same methods of treatment with photocoagulation is being applied to some cases of diabetic retinopathy and to patients with holes or tears of the retina. Either the xenon arc or the laser beam are used as a source of intense light. The desired result is the formation of a scar, which will seal off the hole or tear in the retina and prevent retinal detachment. In the diaebtic cases the scar obliterates the bleeding capillaries and small vessels or arterioles and prevents recurrent hemorrhages.

Above all, these patients must be reassured that they will not become totally blind, that they will be able to take care of themselves and lead useful lives within the limits of their capabilities. Further investigation may be helpful in determining the causes of this condition and its prevention or amelioration.

Vascular Occlusions of the Retina

The effect of retinal artery and vein occlusions on visual acuity varies from minimal to catastrophic. Occlusion of small branches may cause only mild visual disturbances of short duration. This may not even be known to the patient unless the central retinal area, the macula, is involved. However, occlusion of a large branch of the central retinal artery or vein, or complete occlusion of the main vessel will cause extreme loss of vision in the affected eye.

Arterial occlusion may be caused by small emboli from atheromatous plaques in the aorta or carotid arteries or by actual atherosclerosis of the central retinal artery or its branches. This is an ocular emergency. If it is to be helped at all, it must be within the first 6 hours, especially if either the central artery or a branch artery which supplies the macular area is involved. The retina, like brain tissue, undergoes autolysis and necrosis quickly from ischemia so that even if circulation is restored, vision remains permanently impaired.

Recently, fibrinolysis has been used with dramatic results in some patients with arterial occlusion. This treatment requires hospitalization and the intravenous use of fibrinolysin under careful observation. It should certainly be given consideration, although the number of cases reported is still small.

Venous occlusions are most often due to thromboses caused by pressure from a crossing artery or by constriction of the vein as it passes through the laminacribrosa of the optics nerve. An endophlebitis at the site of obstruction has been noted in pathological specimens. The slowing down of the blood stream and the damming back caused by the obstruction in the veins lead to clot formation.

The main symptom is visual loss, especially when the macula is involved. A branch occlusion will cause a sector-shaped defect in the visual field; if the macula is not involved, this will cause little disturbance. Occlusion of the central retinal vein always results in considerable loss of vision, because the macula is badly damaged by the resultant hemorrhage.

For the past few years, improvement in this disease has resulted from the use of anticoagulants. I know of several patients in whom the disease cleared up completely and normal vision was restored. This treatment is particularly effective in branch occlusion. Complete venous occlusions do not fare as well. The treatment is started as soon as the diagnosis is made and should be maintained for many months, even years. The usual precautions have to be observed with reference to frequent testing of the prothrombin time. Fibrinolysin has also been used in this disease. Experience with this new treatment is in its early stages, but it seems to be effective in some patients and may be followed by the use of anticoagulants.

A not infrequent sequel to complete venous occlusion is a secondary glaucoma of an hemorrhagic type. It is difficult to control and may require enucleation for relief of pain.

Retinal Detachment

This condition by no means limited to older people can cause a complete loss of vision. The need for treatment must be weighed against some of its dangers. Results have improved markedly since the early days of Gonin, who first suggested electric cautery for closure of the retinal tear.

At present, the usual method consists of the formation of a scleral buckle to approximate the choroid to the detached retina. Surface diathermy at the site of the buckle causes an adhesive choroiditis which keeps the retina attached. The subretinal fluid is allowed to escape through a small opening made in the choroid, and this still further facilitates the rapprochement between choroid and retina. To localize the retinal tear and to make sure that it is sealed off, the retina is observed through a dilated pupil with a binocular indirect ophthalmoscope.

This is done under general anesthesia and may require 3 to 4 hours. One must weigh the advantage of a possible cure of the disease against the dangers inherent in such prolonged anesthesia in an older person. If the patient has good vision in the remaining eye and life expectancy is not too great, one would hesitate to subject the patient to such a prolonged procedure. But if the detachment occurs in the patient's only good eye, one might be willing to take the risk to preserve some vision.

Preventive Ophthalmology

The problems associated with protecting the eyes in the aged do not differ very much from those in other age groups. In the aged the prevention of accidents that might harm the eye assume a special form because of associated afflictions that impair the strength and stability of the elderly. In a home for the aged special measures should be taken to avoid such accidents as falling down stairs or in bathtubs and on slippery floors. Handrails are provided and ramps are used wherever possible in place of stairs. The floors have roughened surfaces and there are rubber mats in bathrooms to provide a firmer grip for the feet. Canes give a greater sense of security and support, although some residents refuse to use them because of the implications of infirmity and old age.

Good lighting is another safety measure. Illumination should be of uniform degree and without glare in all areas of activity; halls, stairways, bathrooms, and bedrooms. Night lights are desirable, since old folks often get up during the night, and fumbling around in the dark for slippers or bathrobe can be hazardous. The night light may be a soft indirect light, easily switched on or allowed to stay on all night. Open exposed bulbs are undesirable because they create glare and shadows. Fluorescent bulbs or frosted bulbs are better, especially if they are used with a diffusing fixture.

On admission to the home, each resident should have an eye examination. New glasses are supplied if they are needed, and other necessary treatment is given. A periodic eye checkup is done at least once a year, more often if required. Much loss of vision resulting from glaucoma, eye infections, tumors, or cataracts can be prevented in the aged population in general by periodic eye checkups. There is a need for informing the elderly and agencies associated with them of special ocular conditions in the aged. In response to this need, an association of ophthalmologists has published a pamphlet entitled "Seeing Well As You Grow Old" for distribution to the medical profession, social service agencies, and old age clubs (*15*).

The need for protective lenses, while not as urgent as in industry, in children, and in young adults, still exists in the aged. Such residents of a home for the aged who work in occupational therapy, using cutting and grinding instruments, should wear unbreakable or plastic lenses. These have the advantage of being light in weight and unbreakable.

Drugs in Treatment

Elderly people are subject to infirmities not often found in younger age groups, for example, chronic arthritis, Parkinson's disease, prostatism, and gastrointestinal diseases. Sometimes in the treatment of these diseases drugs are used which endanger the eyes of the patient. The eye physician and the patient should be aware of this possibility and check on all medications. Drugs containing atropine or atropine-like substances can cause dilation of the pupil and increased intraocular pressure, which is a real hazard in patients who have glaucoma. Such drugs as Butazolodine Alka, which is used in arthritis, contain homatropine. Artane, used commonly in Parkinson's disease to relax muscle spasm, has an atropine-like effect and should be used with caution in glaucoma patients. Occasionally it may precipitate an attack of glaucoma in a predisposed but undiagnosed patient.

Recently, it has been shown that steroids, used extensively in painful and crippling arthritis, may cause posterior subcapsular cataracts (*16*) and increased intraocular pressure (*17*). This creates a difficult situation for the internists and the ophthalmologist, who have to decide which is the least undesirable condition. There are arthritis patients on small doses of prednisone who experienced an increase in intraocular pressure. The drug had to be replaced by a milder preparation.

Cooperation between physicians also prevented serious loss of vision in a patient who was being treated by a dermatologist for lesions on the face, diagnosed as lupus erythematosus. The dermatologist was aware that the drug he was using, chloroquine phosphate, if given over a long period of time, may cause pigmentary deposits in the retina, around and in the macular region (*18, 19*). He therefore sent the patient to an ophthalmologist for frequent checkup of the vision and fundus. After a period of time, pigmentary deposits were noted around the macula and treatment with chloroquine phosphate was stopped before there was any loss of vision.

With the tremendous increase in numbers of new drugs, many of which are great advances in therapy, it is important to know the possibilities of undesirable and dangerous side effects. The Physicans Desk Reference (*20*) to these new drugs is a valuable office aid. It has been suggested that all prescribed drugs should carry the generic or brand name on the label so that the patient will know exactly what he is getting and can notify all his physicians. The mystery of drug prescription may thus disappear, but the safety will increase.

Preventive measures should be taken in ocular surgery to avoid such undesirable complications as postoperative psychoses and vascular accidents. Local antibiotics used preoperatively and postoperatively have been shown to be instrumental in cutting down the incidence of postoperative endophthalmitis caused by staphylococci and some fungi (*21*). Physical injury to the older patient because of postoperative psychosis may occasionally be anticipated by the ophthalmologist, who can evaluate the personality of the patient and prepare for trouble. The help of a psychiatrist may be necessary to make such an evaluation (*22, 23*). The use of sedatives, side rails, restraints, and the presence of bedside nurses or relatives may be helpful in quieting the unruly patient until the episode is over and the patient is more controllable.

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RESEARCH ON EYE DISEASES AT THE NIH CLINICAL CENTER

LUDWIG VON SALLMANN, M.D.[1]

IT HAS BEEN SUGGESTED that I speak to you today about "Research on Eye Diseases at the NIH Clinical Center." This is not an easy task and unfortunately, my presentation will not be a model of reporting. I realize that the audience is composed of experts from various fields, and this excludes a detailed résumé of some of the manifold and complex studies that are underway. In my opinion it would better serve the purpose of this conference to describe the overall aims of the branch and to emphasize the importance of widening our circumscribed research efforts to the broader horizon of common welfare. This requires that scientists in this age of specialization investigate ways and means to establish a beneficial rapport with the other areas of study.

In the words of a famous biochemist—all that scientists can hope for is to approach the truth through a series of approximations—and approximating is what we are doing.

Let me first describe to you the organization and size of the Eye Branch. On the recommendation of Dr. Jonas Friedenwald, I came to the branch 14 years ago. At that time the facilities made available consisted of 20 modules set aside for laboratory work and 24 beds in the Nursing Unit for clinical investigation. There has been essentially no increase in space allotted to the Ophthalmology Branch since that time. The professional clinical staff includes two senior ophthalmologists; myself, and an associate who shares with me the responsibility for clinical activities. Over the years, this position has been held in sequence by four experienced clinicians. The main workload of patient care rests on the shoulders of four clinical associates who are assigned to the branch for only 2 years.

To indicate the extent of the clinical program, in the past year Ophthalmology recorded approximately 7,600 inpatient days, 2,800 outpatient examinations and 1,700 consultation requests.

The laboratory personnel is grouped into six sections: Physiology, Cell Biology, Cell Metabolism, Chemistry, Pharmacology, and Experimental Embryology. There are 18 laboratory investigators of professional grade, or about 3 times the number of clinical ophthalmologists. This ratio is reflected in the relative numbers of clinical and laboratory reports published from the branch. Of approximately 400 published articles, one-third deal with patient investigations. The original selection of clinical problems to be studied by the branch was influenced by two factors; first, the need for research into those diseases which lead the list of eye disorders resulting in blindness such as glaucoma, retinal degeneration, and uveitis; and second, the feasibility of conducting such research within the organizational framework of NIH. For example, although retinal vascular disease was selected for study, the area of diabetic retinopathy had to be specifically excluded despite the early suggestion of Dr. Friedenwald that the whole branch be built around this subject. It had to be excluded because no diabetes project of any size was established at that time by the National Institute for Arthritis and Metabolic Diseases. Also, the absence of a Pediatrics Service as such, has necessarily restricted work with children. This has been no disservice to the community as Children's Hospital in Washington has an active group working in Pediatric Ophthalmology. Other blinding diseases such as retinal detachment and corneal disease requiring transplantation procedures had to be omitted in view of the size of the Nursing Unit in which only 75 percent of the 24 beds are now at our disposal.

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The clinical problems when thought to be most suitable for study by the Ophthalmology Branch were uveitis, glaucoma, degenerative diseases of the retina, vascular retinopathies, ocular tumors, corneal infections, and cataract. Research in the basic disciplines of chemistry, physiology, pharmacology, and histology was principally planned to expand our knowledge of the function and structure of the normal eye and by this knowledge to stimulate, and support clinical investigations.

After lapse of more than a decade the question of first importance is whether this organization has fulfilled its promise—has the work of the branch helped ophthalmology and vision research. An answer to this question requires some soul searching before conclusions can be drawn. In one area, that of retinal function, integration of basic research and clinical studies has been most productive. The backbone of the multidisciplinary approach has been the study of electrophysiological events occurring in response to light in primitive eyes such as that of the leech, the horseshoe crab, and the turtle, as well as in the complex retina of primates. In this project, five sections of the branch have contributed extensive work on the ultrafine anatomy of the retina, on metabolic pathways in the retina, on the metabolism of visual receptors, and on the physiochemical and biochemical analysis of rhodopsin. These basic studies have led to more sophisticated application and interpretation of the clinical electrophysiological and psychophysical testing of patients with one or the other of the many forms of retinal degenerations which is directed towards distinguishing the various subgroups of this still mysterious disease. The results of meticulous examinations and followup studies of such patients and their families gives hope to some, and permits others to prepare for the possibility or probability of visual incapacitation. While it is true that no effective therapy has yet been discovered, every bid of knowledge gained may make possible tomorrow what is impossible today.

The research orientation of the Clinical Center offers a unique opportunity to apply a great variety of laboratory tests for diagnostic screening of patients with inflammatory and vascular diseases of undetermined origin. Such patients are examined with an unusual armamentarium of tests and to the best of our present knowledge, no stone remains unturned. Nevertheless, the resulting diagnoses remain only presumptive. The etiologic basis of many of these conditions still eludes us. However, in some cases, chemotherapy with possible successful attack against suspected etiologic agents has been successful. Generally, most improvements consist of suppression of symptoms through therapy with anti-inflammatory drugs belonging to the corticosteroid family and more recently some immunosuppressive agents, in addition to the beneficial value of hospitalization. This guarded impression should by no means minimize the importance of the conscientious help of expert consultants from other units or institutes in continuing the search for causes and appropriate therapy of these diseases.

No recent breakthrough can be cited with regard to the control of increased intraocular pressure in glaucoma. However, careful controlled use of the antiglaucoma drugs presently available has, in the great majority of patients, prevented further loss of vision or visual field and has avoided risky surgical intervention. The cooperation of the Section on Pharmacology has been of great help in the clinical studies. I am convinced that the outstanding scientists on this staff have done a superb job within the limits of the size of the branch and this I do not think is a prodomo statement. I feel that it is an unusual privilege to work with such a dedicated group of investigators and am grateful to be allowed to communicate briefly with this audience about our problems. Our knowledge has been advanced, even if the conclusions reached are only approximations and not final solutions.

INTELLIGENCE OF CHILDREN BLINDED FROM RETINOBLASTOMA

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LEE WILLERMAN, Ph. D.[1]

Introduction

THIS PAPER describes a proposed clinical research project utilizing data from the Model Reporting Area register for the blind.

Retinoblastoma, the most common intraocular tumor of childhood, has an incidence variously estimated from 1 in 14,000 to 1 in 34,000 live births (*1, 2, 3*). The reported frequency seems to have increased in recent years (*4*). The average age at which the tumor appears is 13 months (*5*), with the vast majority of cases being diagnosed before age 3. Discovery of the tumor at birth or during early infancy is frequent.

Most tumors (86–94 percent) appear to develop sporadically, with no known family history or evidence of genetic passage (*4, 6*). The remainder of retinoblastomas have been classified as being of the familial type. Retinoblastoma inheritance has been regarded as of the autosomal dominant type with a high, but variable degree of penetrance (*4, 5*). This variability in penetrance, as well as the problems involved in obtaining accurate and detailed family histories, hinders classification of cases as sporadic or familial with a high degree of certainty. Since improved methods of treatment now result in survivors capable of producing children (*5*), it seems reasonable to expect that the incidence of familial tumors will increase in the future.

Bilateral involvement appears in 18 to 31 percent of the sporadic and 49 to 60 percent of the familial cases (*7, 8, 9, 10, 11*). It is generally agreed that this phenomenon almost always represents independent foci of growth and not metastatic involvement. (*4*).

Retinoblastoma and Intelligence

Thurrell and Josephson were the first to document the strikingly high intelligence of children blinded from retinoblastoma (*12*). More recently, Williams (*13*) has shown in a much larger series that English children blinded from retinoblastoma are of superior intelligence when compared to either children blinded from other causes or to a randomly selected control group of sighted children. The children tested in his study ranged in age from 5½ to 15½ years.

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Table I

Table I gives the mean IQ of the retinoblasts, the sightless and the sighted controls in Williams' study. The 50 retinoblastoma children obtained a mean IQ 17 points higher than either of the control groups utilizing the Williams Intelligence Test, a modification for blind children of the Stanford Binet Form L–M. In addition, the standard deviation of the retinoblastoma IQ scores is much smaller than for the control groups.

Table II

Table II shows the frequency distribution of the IQ's of the three groups. The most graphic finding is that within the retinoblastoma group there are no cases in the borderline or mentally defective group. All retinoblastoma cases were of average or superior intelligence.

Proposed Research Project

The lowest IQ among the population of 50 retinoblasts in Williams' study was one case with an IQ just below 100. The expected proportion of IQ's below 100 is approximately 50 percent. Even among those from the very highest social strata, to find only one child below 100 is truly remarkable. As an exercise to illustrate this, the IQ's of 50 randomly-selected children from the highest social strata in the Collaborative Perinatal Study (numbering about 50,000 children) were obtained. Though these 50 children had a parent with a professional occupational status and an income above $10,000 per year, six had IQ's below 100. These children of professionals were undoubtedly from a higher socioeconomic class than the entire population of retinoblasts attending schools for the blind in England from which Williams' data were drawn.

We feel that this report of high intelligence in retinoblastoma might provide a new clue in the search for the causes of high intelligence. We

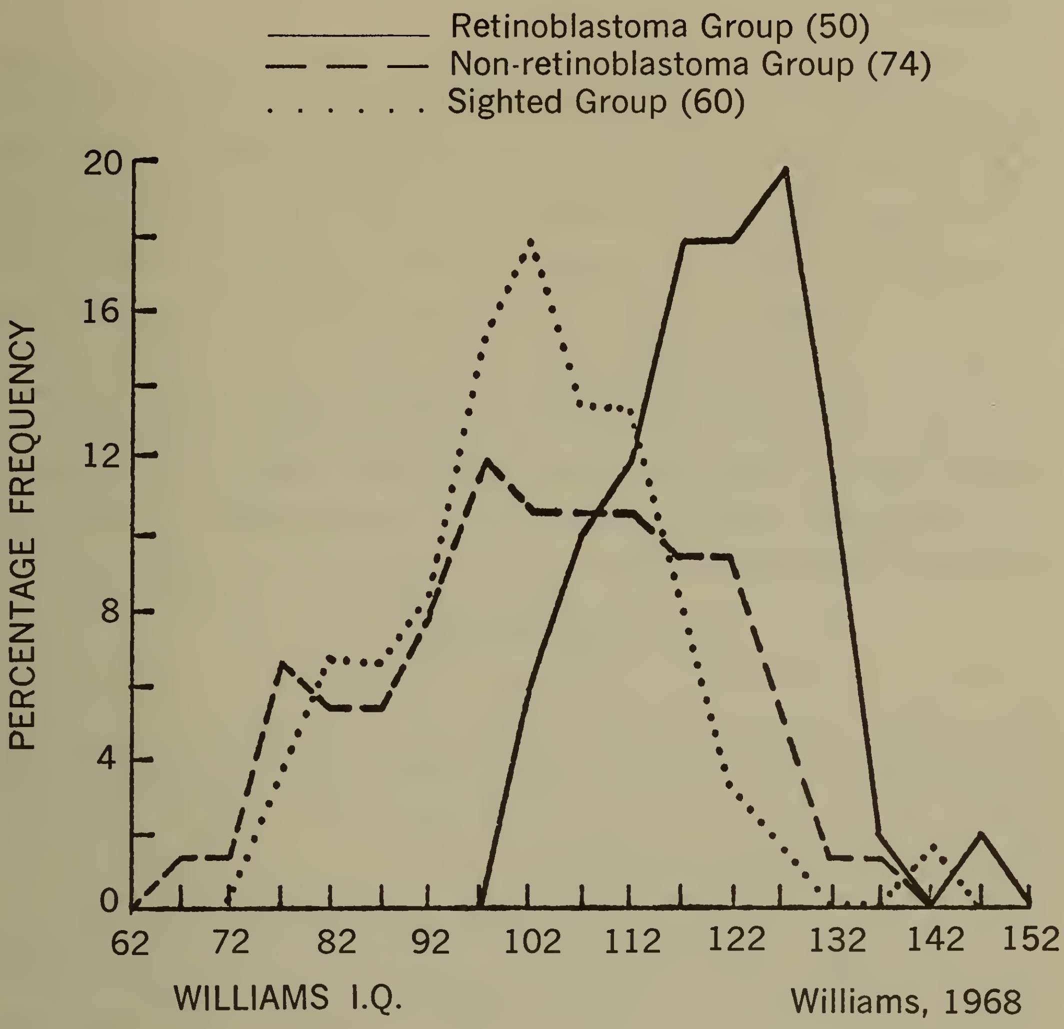
TABLE I

MEANS, STANDARD DEVIATIONS, AND DIFFERENCES IN IQ BETWEEN GROUPS ON THE WILLIAMS INTELLIGENCE TEST

Group	No.	Mean IQ	SD	't'
(a) Retinoblastoma	50	119.72	9.76	7.35
(b) Non-retinoblastoma	74	102.81	15.96	8.23
(c) Sighted	60	102.67	12.01	0.14

From Williams, 1968.

TABLE II



are unaware of any solid data relating any biological phenomenon to high IQ.

The research strategy using the Blindness Register would first involve confirming the positive relationship between retinoblastoma and IQ, and second, delineating the type of relationship between the disease and IQ. Does the retinoblastoma occur with greater frequency among children with high IQ or is there a unique association between the tumor itself and high intelligence? Assuming that Williams' findings can be confirmed, we think that the evidence argues for the latter. These Collaborative Study children from professional families may perhaps have inherited those components making for high intelligence, yet 12 percent of those children had IQ's below 100, whereas only 2 percent of the retinoblasts fell in the same category. If retinoblastoma were simply an epiphenomenon of high IQ, then we might have expected more retinoblasts with IQ's below 100.

The tactics for our proposed research would be to administer IQ tests to the entire families of retinoblasts. If the retinoblasts stand above their families in intelligence, then the focus of further study would be the retinoblasts. If the intelligence of the family is elevated, the unit of study would then be the retinoblast's family.

A further analysis would involve comparing familial and sporadic retinoblastomas to their siblings. If the IQ's of both the sporadic and familial cases (which presumably have different causes) are elevated with regard to their sibs and the general population, the interpretation for the higher IQ in this disease would involve perhaps some biological phenomenon peculiar to retinoblasts. Assuming Williams' results are confirmed, this finding is the most expected one because there are simply not enough familial cases (approximately 6 percent) to sufficiently raise the mean for a population of retinoblasts to 120 IQ. Of course, it is possible that the sporadic cases will be elevated relative to their siblings and the familial cases, but no ready explanation can be offered for such a result.

We think that the Blind Register provides a beautiful opportunity to investigate this exciting finding.

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WHY NEI SHOULD CODE VISUAL SYSTEM AFFECTIONS AND ETIOLOGIES FOR MRA STATES

HELEN B. MOORHEAD[1]

AT THE BEGINNING of the Model Reporting Area (MRA) for Blindness Statistics, someone in each member State coded causes of blindness for the State. Since some of the differences in statistics from State to State were due to coding variations, MRA started a program in 1965 to secure uniform coding of blinding affections and their etiologies. In that year member States sent us a sample of their coded eye reports for review. Beginning with 1966 the members sent us nearly 100 percent of their reports.

From our experience in classifying a large number of reports over the past 4 years, we have concluded that it is not feasible to expect many different coders in widely separated places to classify blindness causes with a high degree of uniformity unless there is central control of coding of all eye reports. Such central control involves a great deal of duplication of effort. The State coder first classifies the eye report, then has the coded report reproduced, and then sent to us. We review each report, verify or change the State code, and return a record of the codes to the State. If we have changed the code, the State must then send us additional information to substantiate its code or make corrections in its records. In many instances this requires introducing corrections into automatic or electronic data processing systems.

In almost all of the States, the person classifying causes of blindness has many other duties. During the past year some of the States sent us their eye reports uncoded, and we have assigned the codes. This has saved time for both the States and us and leads us to suggest that it would be beneficial for us to code blindness causes for all of the States. In addition to time-savings in coding and correcting records, there will be less correspondence required, and it will not be necessary to train new State coders when there are personnel changes.

Eye reports come to the State register agencies in different forms, ranging from notes on prescription blanks to several pages of detailed medical history, and phyiscal, ophthalmological, and laboratory findings.

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The wide variety of report forms adds greatly to the complexity of the coding process. Because of this complexity a classifier needs to code more than a few hundred reports in a year if he is to do them uniformly and consistently. A person who devotes the greater portion of his time to classifying and who codes thousands of reports in a year will code with more speed and uniformity than someone who must code a few reports at a time between other duties.

In addition to the obvious saving of personnel and time, there will be other fringe benefits if we do the classifying. With copies of all eye reports, we can collect additional information when desired, without adding to the workload of the States or necessitating revision in their punched cards. It would be possible to collect additional information, either on a continuing or periodic basis. For instance, if data were desired on different causes of blindness in the two eyes, we could extract this from the eye reports. We could flag conditions reported with an element of uncertainty; that is, diagnoses which the examiner reported as possible, probable, or suspected. We could record other ocular conditions which were present but not coded as the primary cause of blindness; or a history of cataract surgery when something other than cataract is coded as the cause of blindness.

The continued examination of a large number of eye reports will be helpful in developing a future revision of the classification, and in testing such a revision, before adopting it, for comparability with the present classification.

We do see one disadvantage in our doing the coding, and that is that we will lose the double checking which occurs when both we and the States code. We will need to compensate for this by having our coders check each other on a sampling basis.

We will be glad to discuss implementing procedures with any MRA member who wishes us to assume the coding of blindness causes for additions to the register.

We are happy to report that we are now sending the MRA States the results of our review of their eye reports within 2 to 3 months after we receive them, except for those which we refer for ophthalmological consultation. We have not been able to do this for the States preparing for MRA membership, due to the large volume of reports which must be coded when a register is started. We are now training an additional classifier and expect to be able better to assist the States which will be coming into the MRA.

In closing, I would like to acknowledge our debt to those who have been classifying blindness causes in the State agencies. Their comments and questions have helped us to refine classification procedures. We very much appreciate the interest they have shown in furnishing comparable statistics on blindness causes, and we hope that, by doing the coding, we may give them additional time for other phases of the MRA effort.

CODING VISUAL SYSTEM AFFECTIONS AND ETIOLOGIES WITH A COMPUTER

DONALD R. FLEISCHER[1]

THE SEVEN-DIGIT code used to code affections and etiologies of the visual system is described in a manual published by the National Society for the Prevention of Blindness. This manual lists the diagnostic terms with which ophthalmologists describe affections and their etiologies. The corresponding code numbers appear opposite the terms to which they relate. The manual also gives certain rules which must be followed in coding so that a good degree of accuracy and consistency can be obtained.

Little errors are a big problem under present coding methods and the easiest to eliminate when using a computer. A problem that would be alleviated would be to reduce miscoding which arises when the coder makes mistakes (such as transposing numbers) or when the keypuncher makes mistakes. Therefore, checking would be nonexistent because the transformation from words to numbers would not involve any sort of errors. Once a computer system is fully implemented, there should be a great saving in time and expense. Not only will it be faster coding when the computer can do the work at lightning speed, but there will be far less recoding because with proper information the computer will give the correct code the first time around. There will also be greater consistency in coding, because the computer will always code the same diagnosis in the same way.

To have a good operational computer system would require that any input be in natural language, so that a knowledgeable person could examine it to see that it was correct and did not contain any obvious errors. This, together with the fact that the coder can code using terms which have some meaning in themselves will help to greatly improve the accuracy of the whole procedure.

The computer would be able to give varied outputs depending upon the needs of the user. A standard output might consist of the alphabetic diagnostic term to be coded and the appropriate code number. Any errors involved in coding would also be printed out.

The method of coding which is the primary concern of this paper, would be one using a "dictionary" approach. Under this approach, in the computer memory there would be a dictionary of affections in alphabetical order with their corresponding three-digit codes, and a dictionary of etiologies in alphabetical order with their corresponding four-digit codes. This would be the basic structure and any diagnosis would be read into the computer, and then analyzed and compared with these dictionaries to determine the correct seven-digit code. This approach could be expanded to include other dictionaries in which comparisons would be made to alleviate as many errors as possible.

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Another clever approach to this problem would be the "fruit machine" method, a name which arises from trying to line up similar codes much as the slot machines line up lemons or oranges in order to get the jackpot. And, likewise, when our codes line up, the correct seven-digit code comes out as our jackpot. This is somewhat similar to the "dictionary" approach because it would first be necessary to develop a list of all affections in alphabetical order. Then for each affection list all etiologies by four-digit code number that could possibly be associated with it and the corresponding seven-digit code. Similarly, for all etiologies give a list of all possible affections by their three-digit code that could be associated with each etiology and the corresponding seven-digit code. Then when a diagnosis is fed into the machine find all possible seven-digit codes that could be used for the affection, and all possible seven-digit codes that could be used for the etiology. The computer or "fruit machine" will then match these and print out the unique seven-digit code which is common to both sets of data. This method involves an inherent test of consistency but it would be much more difficult to develop and implement and would be subject to continual change.

One big area of concern in developing a system is the determination of a code where there is more than one possibility, such as might result when there is more than one condition affecting the eye. If possible, it is necessary to determine the primary condition which caused blindness, a check the computer could make if the necessary data were available. For instance, if age at onset were included for the various affections, it would be possible to determine the initial cause of blindness.

There are other problems that will arise in trying to implement a computer system of this sort. Decisions will have to be made on the types of error checks desired. Such error checks as the following might be included: Make sure the diagnostic term read in as input is spelled correctly; if a diagnosis is not in the dictionary try to determine the reason (impossible, misspelled, etc.) and make appropriate adjustments if possible. Once a seven-digit code has been established, check to make sure that the etiology is consistent with the affection that is coded. Another check which is a little bit more refined is to check on previous coding to determine the frequency of the codes and hence, have a check on the reasonableness of the seven-digit codes assigned. If a brand new diagnosis and a seven-digit code is acceptable, the dictionaries should be updated to take care of the new diagnosis.

As might be guessed from this discussion, such a computer system will require large storage requirements and necessitate the use of fairly sophisticated equipment. By good programing and proper implementation a good, efficient system could be developed but determination must first be made as to whether the cost of the system will be worth it. There could be all levels of a system developed, from one in which the computer does elementary bookkeeping type operations to one in which it takes the eye examination report from scratch and codes the affection and etiology from it.

The next problem is to consider the specifics in a computer system that would be used to code blinding affections and etiologies. As things stand now, it would probably be a gradual transition rather than one big leap into an overall system. This paper discusses a suggested format for implementation and could be very different from a procedure undertaken if such a system were to be put into actual working order.

The first step would have the computer assign codes to the diagnostic terms recorded in the eye examination reports after they have been converted manually to make them acceptable to the computer. From each eye examination report the coder would extract a diagnostic term describing the eye condition and convert this term to one that the computer will accept. Each of the converted terms will have one or more words to designate the affection and one or more words to designate the etiology. Along with these converted diagnostic terms, appropriate dictionaries and a computer program to analyze the diagnostic terms would be fed into the computer. One dictionary would have the affections in alphabetical order with the corresponding three-digit code and another dictionary would have etiologies in alphabetical order with the corresponding four-digit code. The converted diagnostic terms which would be fed into the computer would be such that each would have an affection which could be found in the affection dictionary and an etiology that could be found in the etiology dictionary. The computer program would analyze these converted diagnostic terms, compare them with entries in the dictionaries and then print out the correct seven-digit codes. Such a program could be developed along the lines of the flow in chart in figure 1.

One example of coding might be diabetic retinopathy which would appear as the cause of blindness on the eye examination report form. A coder would manually convert this to retinopathy (due to) diabetes so that the computer could analyze it into the affection of retinopathy and the etiology of diabetes mellitus to arrive at a code 615–62.10.

As can be seen, this first step merely has the computer assigning code numbers to very specific diagnostic terms. It would definitely take more time than at present, but accuracy would probably be increased and it would be a first step in developing our computer system for coding.

The second step in the development of our system would be an elaboration of the first in which the coding is done in much the same manner but there are now error checks included to make sure the etiology is consistent with the affection. The same procedure will be followed as described for the previous step. In addition, two "subdictionaries" will be fed into the computer. One will be a dictionary showing those seven-digit codes for which the etiology is not correct for the affection coded, but for which there is a suitable seven-digit code for this diagnosis. For example, the affection optic nerve atrophy has a code of 720 and the etiology, multiple sclerosis has a code of 65.10 but the seven-digit code should be 710–65.10. Therefore, this subdictionary would show that the code 720–65.10 should be transformed into 710–65.10. The other subdictionary would be a list of all acceptable seven-digit codes.

After the computer has assigned codes based on the converted diagnostic terms read into it, it would check against these subdictionaries for any inconsistencies. Figure 2 gives an idea of a flow chart. The output would give the converted diagnostic terms and the corresponding seven-digit code as well as any errors.

For example, optic nerve atrophy due to multiple sclerosis would be fed into the computer and an initial code of 720–65.10 would be determined. After checking against the subdictionary this code would be changed to 710–65.10 and after checking against the second subdictionary would be considered a correct code.

As another example, consider the case of trying to feed in an impossible diagnostic term. An initial code would be assigned by the computer but upon checking against the second subdictionary it would be rejected because this particular seven-digit code would not be listed and would therefore be considered unacceptable.

This second step in the implementation of a system would obviously help to increase accuracy, and speed would be increased if the coding were being done by an inexperienced coder. This would also eliminate some of the need for checking of one coder by another because obvious inconsistencies would be eliminated. However, if only experienced coders were available, the time required will still be more than at present.

The third step in developing our system would be to add another dictionary which would contain entries enabling us to analyze entries which do not appear in the main dictionaries but are diagnostic terms which would have synonomous entries in the main dictionaries. This would be done in order to eliminate much of the manual conversion necessary for terms to be acceptable to the computer. The idea would be the same as described previously but the computer would now be able to accept such phrases as diabetic retinopathy instead of having to manually convert this to retinopathy (due to) diabetes, or it could accept german measles in place of rubella. It would be necessary to update this dictionary continually to take care of all synonomous terms but it would be a very valuable step in the implementation of our system and reducing the work of a coder.

The fourth step, and a very big one would be to have the computer select the diagnostic term for coding from information given it. The history of the patient and any other information would be given the computer and it would then decide on the terms to be coded. It would then proceed to steps previously described to arrive at the proper seven-digit code or decide on any errors involved. This step is still very much in the future but with the advances being made in the computer field it is not unreasonable to contemplate such a move. Figure 3 gives an idea of the flow chart of such a computer program.

The final step in our system would be to have the eye examination report fed directly into the computer which would do all the work, and it would refer any problems it encountered to the consulting ophthalmologist. To accomplish such a procedure would require advanced equipment, but more important it would require a standardized eye report form which was clear and legible and which had some consistency in the procedure for filling out such a report. These requirements for an eye examination report are essential today if we are to just make our present coding methods more efficient.

As things stand now, the first step in our system could probably be implemented but it would require a larger staff than now available. The skilled coders are presently overworked and if it were decided to go ahead with implementation, it would be necessary to hire a coding clerk who, with minimum training, could look at the eye examination reports and determine which could readily be done by the computer. At present estimates such an inexperienced coder could handle no more than 25 percent of the present coding assignments but even this estimate might be high due to the large variety and inconsistencies among reports. At the present time implementation would be very difficult, because with an increasing volume of coding the present staff needs all of its available time and the first step of implementation would require more of their time, rather than less. In addition, there are things of a higher priority nature, so it is hard to say when any attempt to implement such a system will be undertaken.

FLOW CHART OF COMPUTER PROGRAM
TO ASSIGN CODES TO CONVERTED DIAGNOSTIC TERMS

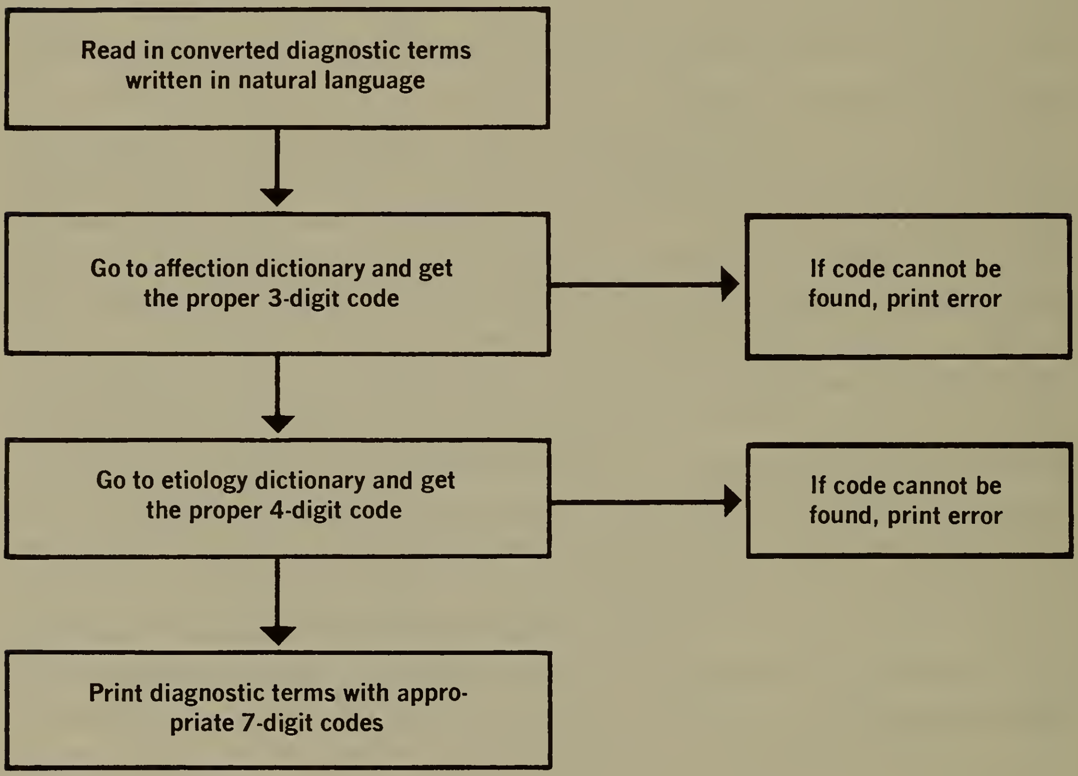
Read in converted diagnostic terms written in natural language
Go to affection dictionary and get the proper 3-digit code
If code cannot be found, print error
Go to etiology dictionary and get the proper 4-digit code
If code cannot be found, print error
Print diagnostic terms with appropriate 7-digit codes

FIGURE 1

FLOW CHART OF COMPUTER PROGRAM TO ASSIGN CODES AND PERFORM NECESSARY ERROR CHECKING

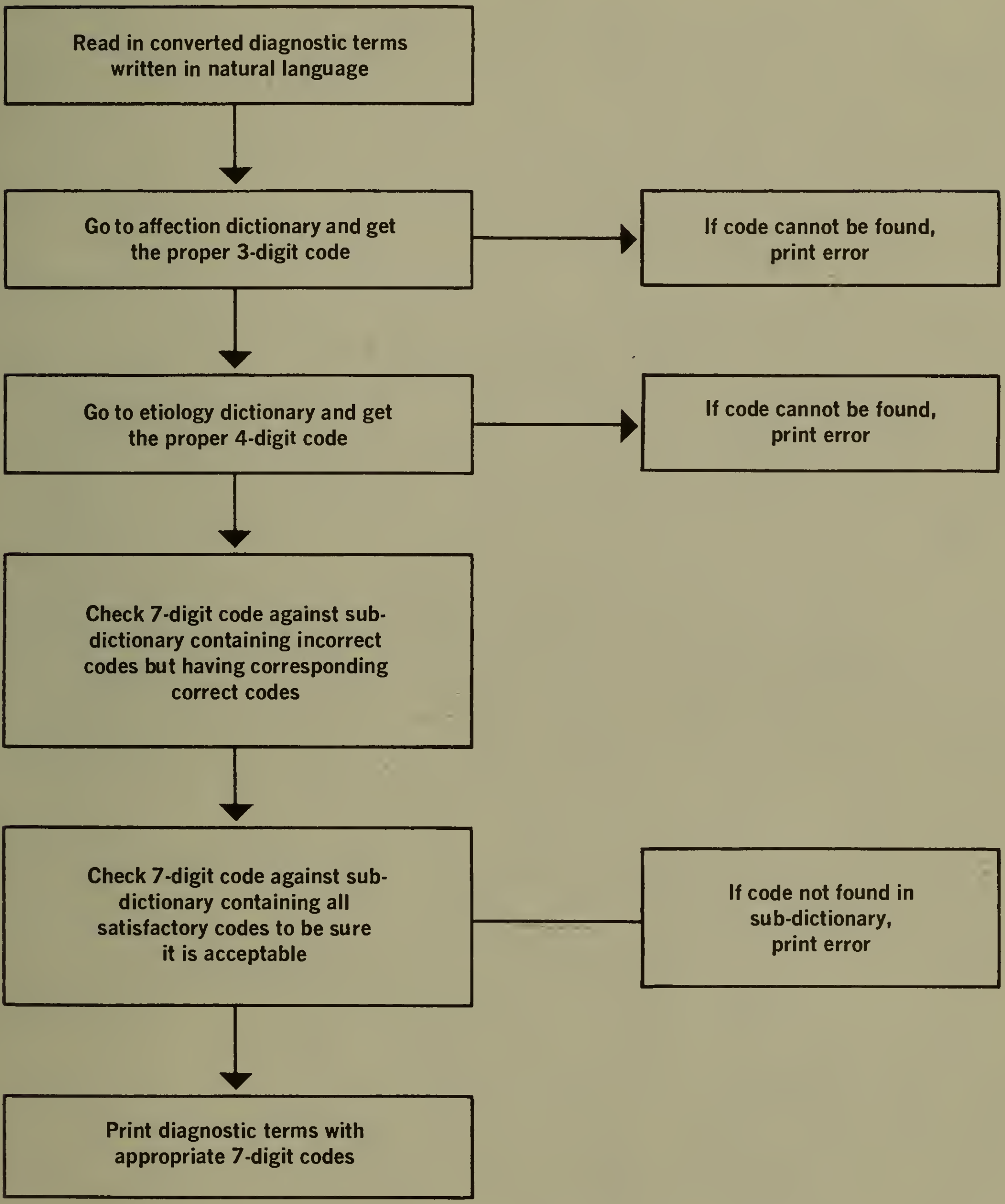
Read in converted diagnostic terms written in natural language
Go to affection dictionary and get the proper 3-digit code
If code cannot be found, print error
Go to etiology dictionary and get the proper 4-digit code
If code cannot be found, print error
Check 7-digit code against sub-dictionary containing incorrect codes but having corresponding correct codes
Check 7-digit code against sub-dictionary containing all satisfactory codes to be sure it is acceptable
If code not found in sub-dictionary, print error
Print diagnostic terms with appropriate 7-digit codes

FIGURE 2

FLOW CHART OF COMPUTER PROGRAM TO ANALYZE A DIAGNOSIS WHEN HISTORY OF THE PATIENT IS CONSIDERED

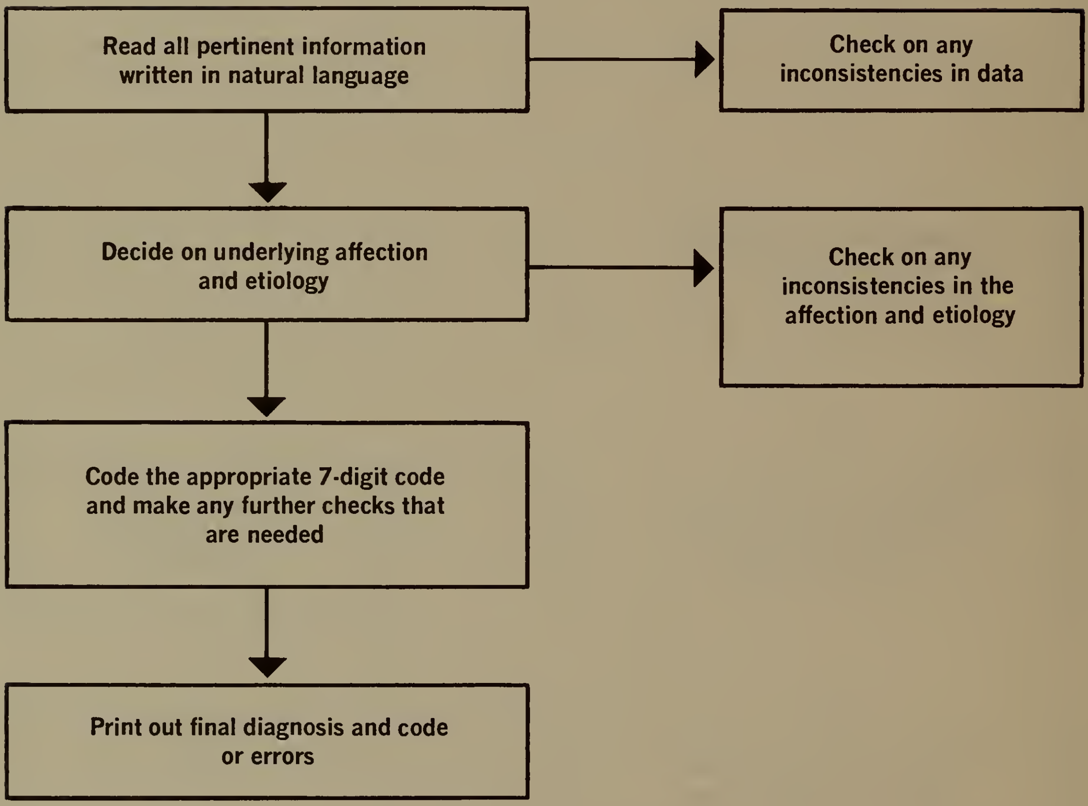
Read all pertinent information written in natural language
Check on any inconsistencies in data
Decide on underlying affection and etiology
Check on any inconsistencies in the affection and etiology
Code the appropriate 7-digit code and make any further checks that are needed
Print out final diagnosis and code or errors

FIGURE 3

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